Allen-Bradley

PowerFlex® 70

Adjustable Frequency AC Drive

User Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. "*Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls*" (Publication SGI-1.1 available from your local Rockwell Automation Sales Office or online at **http://www.ab.com/manuals/gi**) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will the Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, the Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual we use notes to make you aware of safety considerations.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attentions help you:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is especially important for successful application and understanding of the product.

Shock Hazard labels may be located on or inside the drive to alert people that dangerous voltage may be present.

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PLC is a registered trademark of Rockwell Automation.
ControlNet is a trademark of ControlNet International, Ltd.
DeviceNet is a trademark of the Open DeviceNet Vendor Association.

The information below summarizes the changes to the PowerFlex 70 User Manual since the July 2002 release.

Description of New or Updated Information	See Page(s)
IP66 (NEMA Type 4X/12) enclosure added to Catalog Number Explanation.	Preface-5
IP66 (NEMA Type 4X/12) cover removal and installation added.	1-2
Maximum surrounding air temperature guidelines clarified for all drive enclosure types.	1-2, A-1
Minimum mounting clearances clarified for all drive enclosure types.	1-2
Recommendations for Shielded/Armored cables added.	1-6
Wire routing recommendations include IP66 (NEMA Type 4X/12) enclosure information	1-8, 1-13
The following parameter descriptions or values have changed:	
[DC Bus Voltage] – Min/Max values are 0.0/Based on Drive Rating	3-8
[DC Bus Memory] – Min/Max values are 0.0/Based on Drive Rating	3-8
[Maximum Voltage] – Min/Max values are Rated Volts × 0.25/Rated Volts	3-10
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The information below summarizes the changes to the PowerFlex 70 User Manual since the October 2001 release.

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Minimum Mounting Clearances reduced for all drive ratings.	1-2
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Information on using input/output contactors added.	1-10
Wiring Examples expanded to provide more detail.	1-15
Speed Reference Selection Chart clarified.	1-17
EMC Instructions updated.	1-19
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The following parameter descriptions or values have changed:	
[Output Powr Fctr] – Min/Max values are 0.00/1.00	3-8
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[Motor NP Power] – Min/Max values are 0.00/100.00	3-9
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[Stop Mode x] – Parameter details added to Appendix C	3-19
[Bus Reg Mode x] – Parameter details added to Appendix C	3-20
[DB Resistor Type] – Description changed.	3-21
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Communication Configurations added to Appendix A.	A-3
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Drive dimensions added to Appendix A	A-6
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Overview

The purpose of this manual is to provide you with the basic information needed to install, start-up and troubleshoot the PowerFlex 70 Adjustable Frequency AC Drive.

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Reference Materials	P-2
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Drive Frame Sizes	P-3
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Who Should Use this Manual?

This manual is intended for qualified personnel. You must be able to program and operate Adjustable Frequency AC Drive devices. In addition, you must have an understanding of the parameter settings and functions.

What Is Not in this Manual

The *PowerFlex 70 User Manual* is designed to provide only basic start-up information. For detailed drive information, please refer to the *PowerFlex Reference Manual*. The reference manual is included on the CD supplied with your drive or is also available online at **http://www.ab.com/manuals**.

Reference Materials

The following manuals are recommended for general drive information:

Title	Publication	Available Online at …
Industrial Automation Wiring and Grounding Guidelines	1770-4.1	**www.ab.com/manuals/gi**
Preventive Maintenance of Industrial Control and Drive System Equipment	DRIVES-TD001A-EN-E	**www.ab.com/manuals/dr**
Safety Guidelines for the Application, Installation and Maintenance of Solid State Control	SGI-1.1	**www.ab.com/manuals/gi**
A Global Reference Guide for Reading Schematic Diagrams	0100-2.10	**www.ab.com/manuals/ms**
Guarding Against Electrostatic Damage	8000-4.5.2	**www.ab.com/manuals/dr**

For detailed PowerFlex 70 information:

Title	Publication	Available …
PowerFlex Reference Manual	PFLEX-RM001…	on the CD supplied with the drive or at **www.ab.com/manuals/dr**

For Allen-Bradley Drives Technical Support:

Title	Online at …
Allen-Bradley Drives Technical Support	**www.ab.com/support/abdrives**

Manual Conventions

- In this manual we refer to the PowerFlex 70 Adjustable Frequency AC Drive as; drive, PowerFlex 70 or PowerFlex 70 Drive.
- To help differentiate parameter names and LCD display text from other text, the following conventions will be used:
  - Parameter Names will appear in [brackets].
    For example: [DC Bus Voltage].
  - Display Text will appear in “quotes.” For example: “Enabled.”
- The following words are used throughout the manual to describe an action:

Word	Meaning
Can	Possible, able to do something
Cannot	Not possible, not able to do something
May	Permitted, allowed
Must	Unavoidable, you must do this
Shall	Required and necessary
Should	Recommended
Should Not	Not recommended

Drive Frame Sizes

Similar PowerFlex 70 drive sizes are grouped into frame sizes to simplify spare parts ordering, dimensioning, etc. A cross reference of drive catalog numbers and their respective frame size is provided in Appendix A.

General Precautions

ATTENTION: This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, "Guarding Against Electrostatic Damage" or any other applicable ESD protection handbook.

ATTENTION: An incorrectly applied or installed drive can result in component damage or a reduction in product life. Wiring or application errors, such as, undersizing the motor, incorrect or inadequate AC supply, or excessive ambient temperatures may result in malfunction of the system.

ATTENTION: Only qualified personnel familiar with adjustable frequency AC drives and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the +DC terminal of the Power Terminal Block and the -DC test point (refer to Chapter 1 for locations). The voltage must be zero.

ATTENTION: Risk of injury or equipment damage exists. DPI or SCANport host products must not be directly connected together via 1202 cables. Unpredictable behavior can result if two or more devices are connected in this manner.

ATTENTION: A risk of injury or equipment damage exists in firmware version 1.011 and earlier. When there is a combination of long shielded motor cables, high source impedance, low speed, light motor load and parameter 190 [Direction Mode] is set to "Unipolar" or "Bipolar," an unexpected change in motor direction may occur. If these conditions exist, choose one of the following corrective actions:

- Set parameter 190 to "Reverse Dis"
- Set parameters 161 and 162 to "Disabled"
- Install a properly sized Dynamic Brake resistor

ATTENTION: Nuisance tripping may occur in firmware version 1.011 and earlier due to unstable currents. When using a motor that is connected for a voltage that is different from the drive (e.g., using a 230V connected motor with a 460V drive) the following adjustment must be made to "Stability Gain" using DriveExplorer software and a personal computer.

$$\frac{\text{Motor Nameplate Voltage}}{\text{Drive Rated Voltage}} \times 128$$

Any adjustment made to "Stability Gain" must be manually restored if the drive is reset to defaults or is replaced.

If unstable currents are still present after making the adjustment, contact the factory for assistance.

ATTENTION: The "adjust freq" portion of the bus regulator function is extremely useful for preventing nuisance overvoltage faults resulting from aggressive decelerations, overhauling loads, and eccentric loads. It forces the output frequency to be greater than commanded frequency while the drive's bus voltage is increasing towards levels that would otherwise cause a fault; however, it can also cause either of the following two conditions to occur.

1. Fast positive changes in input voltage (more than a 10% increase within 6 minutes) can cause uncommanded positive speed changes; however an "OverSpeed Limit" fault will occur if the speed reaches [Max Speed] + [Overspeed Limit]. If this condition is unacceptable, action should be taken to 1) limit supply voltages within the specification of the drive and, 2) limit fast positive input voltage changes to less than 10%. Without taking such actions, if this operation is unacceptable, the "adjust freq" portion of the bus regulator function must be disabled (see parameters 161 and 162).
2. Actual deceleration times can be longer than commanded deceleration times; however, a "Decel Inhibit" fault is generated if the drive stops decelerating altogether. If this condition is unacceptable, the "adjust freq" portion of the bus regulator must be disabled (see parameters 161 and 162). In addition, installing a properly sized dynamic brake resistor will provide equal or better performance in most cases.

Note: These faults are not instantaneous and have shown test results that take between 2 and 12 seconds to occur.

20A	B	2P1	A	1	A	Y	Y	N	N	N	N
Drive	Voltage Rating	Rating	Enclosure	HIM	Documentation [1]	Brake IGBT	Brake Resistor	Emission Class	Comm Slot		

Code	Type
20A	70
20B	700

Code	Voltage	Ph.
B	240V AC	3
C	400V AC	3
D	480V AC	3
E	600V AC	3

Code	Type
A	English Manual
P	Portuguese Manual
S	Spanish Manual
N	No Manual

Code	w/Brake Resistor
Y	Yes
N	No

Code	w/Brake IGBT
Y	Yes

Code	Version
C	ControlNet (Coax)
D	DeviceNet
R	RIO
S	RS485 DF-1
N	N/A

Code	Interface Module
0	Blank HIM
1	Digital LED HIM
2	Digital LCD HIM
3	Full Numeric LCD HIM
4	Analog LCD HIM
5	Prog. Only LCD HIM

Code	Rating
A	Filtered (Excluding 600V AC)
	A[2] & B Frames (Optional)
	C & D Frames (Standard)
N	Not Filtered
	A & B Frames (Optional)
	C & D Frames NA (600V AC only)

[1] All drives ship with multilingual Quick Starts.
[2] Increases A Frame size to B.

Code	Enclosure
A	Panel Mount - IP 20 (NEMA Type 1)
C	Panel Mount - IP 66 (NEMA Type 4X/12)
F	Flange Mount - Front = IP 20 (NEMA Type 1), Heatsink = IP66 (NEMA Type 4X/12)

Output Current @ 600V 60Hz Input			Output Current @ 480V 60Hz Input			Output Current @ 400V 50Hz Input			Output Current @ 240V 60Hz Input			Output Current @ 208V 60Hz Input		
Code	Amps	kW (HP)	Code	Amps	kW (HP)	Code	Amps	kW (HP)	Code	Amps	kW (HP)	Code	Amps	kW (HP)
0P9	0.9	0.37 (0.5)	1P1	1.1	0.37 (0.5)	1P3	1.3	0.37 (0.5)	2P2	2.2	0.37 (0.5)	2P2	2.5	0.37 (0.5)
1P7	1.7	0.75 (1.0)	2P1	2.1	0.75 (1.0)	2P1	2.1	0.75 (1.0)	4P2	4.2	0.75 (1.0)	4P2	4.8	0.75 (1.0)
2P7	2.7	1.5 (2.0)	3P4	3.4	1.5 (2.0)	3P5	3.5	1.5 (2.0)	6P8	6.8	1.5 (2.0)	6P8	7.8	1.5 (2.0)
3P9	3.9	2.2 (3.0)	5P0	5.0	2.2 (3.0)	5P0	5.0	2.2 (3.0)	9P6	9.6	2.2 (3.0)	9P6	11	2.2 (3.0)
6P1	6.1	4.0 (5.0)	8P0	8.0	3.7 (5.0)	8P7	8.7	4.0 (5.0)	015	15.3	4.0 (5.0)	015	17.5	4.0 (5.0)
9P0	9.0	5.5 (7.5)	011	11	5.5 (7.5)	011	11.5	5.5 (7.5)	022	22	5.5 (7.5)	022	25.3	5.5 (7.5)
011	11	7.5 (10)	014	14	7.5 (10)	015	15.4	7.5 (10)	028	28	7.5 (10)	028	32.2	7.5 (10)
017	17	11 (15)	022	22	11 (15)	022	22	11 (15)						
022	22	15 (20)	027	27	15 (20)	030	30	15 (20)						

Notes:

Installation/Wiring

This chapter provides information on mounting and wiring the PowerFlex 70 Drive.

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Mounting Considerations	1-2
AC Supply Source Considerations	1-3
General Grounding Requirements	1-4
Fuses and Circuit Breakers	1-5
Power Wiring	1-5
Using Input/Output Contactors	1-10

For information on...	See page
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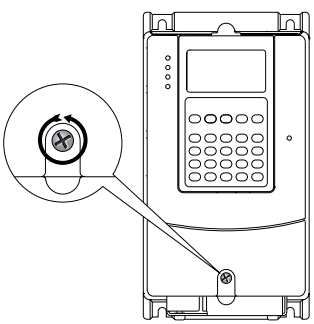
Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All items must be read and understood before the actual installation begins.

ATTENTION: The following information is merely a guide for proper installation. The Allen-Bradley Company cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

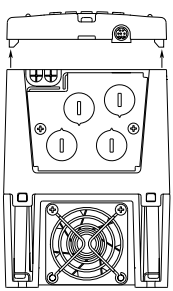
Opening the Cover

IP 20 (NEMA Type 1)

1. Loosen cover screw.

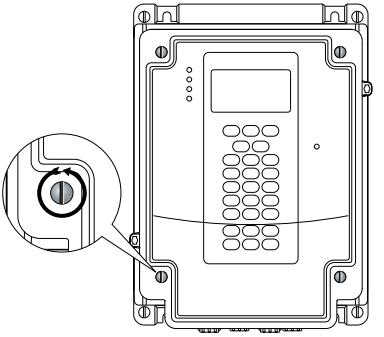


2. Pull cover straight off chassis to avoid damaging connector pins.

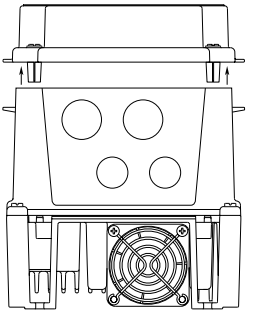


IP 66 (NEMA Type 4X/12)

1. Loosen the 4 cover screws.



2. Pull cover straight off chassis.



Important: Torque cover screws to 0.79 N-m (7 lb.-in.).

Mounting Considerations

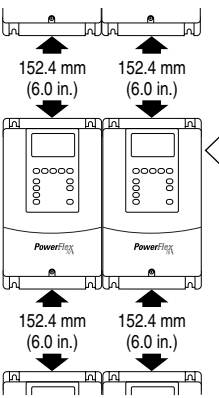
Maximum Surrounding Air Temperature

Enclosure Rating	Temperature Range
Open Type, IP 20, NEMA Type 1 & Flange Mount	0 to 50 degrees C (32 to 122 degrees F)
IP 66 & NEMA Type 4X/12	0 to 40 degrees C (32 to 104 degrees F)

PowerFlex 70 drives are designed to operate at 0° to 50°C (32° to 122°F) surrounding air temperature.

Important: Some drives are equipped with an adhesive label on the top of the chassis. Removing the adhesive label from the drive changes the NEMA enclosure rating from Type 1 Enclosed to Open Type.

Minimum Mounting Clearances



Clearances apply to all PowerFlex 70 Drives:

- Panel Mount
- Flange Mount
- NEMA Type 4X/12

AC Supply Source Considerations

PowerFlex 70 drives are suitable for use on a circuit capable of delivering up to a maximum of 200,000 rms symmetrical amperes, and a maximum of 600 volts.

ATTENTION: To guard against personal injury and/or equipment damage caused by improper fusing or circuit breaker selection, use only the recommended line fuses/circuit breakers specified in Appendix A.

If a system ground fault monitor (RCD) is to be used, only Type B (adjustable) devices should be used to avoid nuisance tripping.

Unbalanced or Ungrounded Distribution Systems

If phase to ground voltage will exceed 125% of normal line to line voltage or the supply system is ungrounded, refer to the *PowerFlex Reference Manual*.

ATTENTION: PowerFlex 70 drives contain protective MOVs and common mode capacitors that are referenced to ground. These devices should be disconnected if the drive is installed on an ungrounded distribution system. See page 1-10 for jumper locations.

Input Power Conditioning

Certain events on the power system supplying a drive can cause component damage or shortened product life. These conditions are divided into 2 basic categories:

1. **All drives**
   - The power system has power factor correction capacitors switched in and out of the system, either by the user or by the power company.
   - The power source has intermittent voltage spikes in excess of 6000 volts. These spikes could be caused by other equipment on the line or by events such as lightning strikes.
   - The power source has frequent interruptions.
2. **5 HP or Less Drives (in addition to "1" above)**
   - The nearest supply transformer is larger than 100kVA or the available short circuit (fault) current is greater than 100,000A.
   - The impedance in front of the drive is less than 0.5%.

If any or all of these conditions exist, it is recommended that the user install a minimum amount of impedance between the drive and the source. This impedance could come from the supply transformer itself, the cable between the transformer and drive or an additional transformer

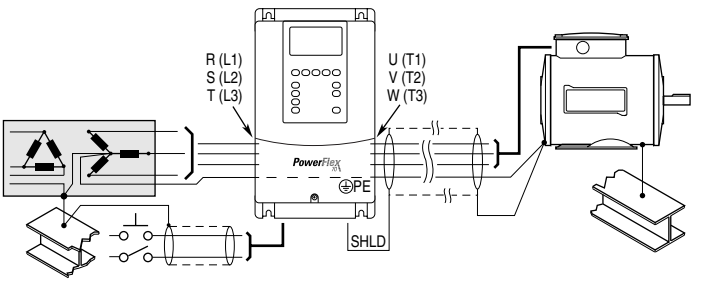
or reactor. The impedance can be calculated using the information supplied in either the *PowerFlex Reference Manual* or the technical document on *Wiring and Grounding Guidelines*, publication DRIVES-IN001A-EN-P.

General Grounding Requirements

The drive Safety Ground - PE must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be periodically checked.

For installations within a cabinet, a single safety ground point or ground bus bar connected directly to building steel should be used. All circuits including the AC input ground conductor should be grounded independently and directly to this point/bar.

Figure 1.1 Typical Grounding



Safety Ground - PE

This is the safety ground for the drive that is required by code. This point must be connected to adjacent building steel (girder, joist), a floor ground rod or bus bar (see above). Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

Shield Termination - SHLD

The Shield terminal (see Figure 1.2 on page 1-8) provides a grounding point for the motor cable shield. It must be connected to an earth ground by a separate continuous lead. The **motor cable** shield should be connected to this terminal on the drive (drive end) and the motor frame (motor end). A shield terminating cable gland may also be used.

When shielded cable is used for **control and signal wiring**, the shield should be grounded at the source end only, not at the drive end.

RFI Filter Grounding

Using an optional RFI filter may result in relatively high ground leakage currents. Therefore, the **filter must only be used in installations with grounded AC supply systems and be permanently installed and solidly grounded** (bonded) to the building power distribution ground. Ensure that the incoming supply neutral is solidly connected (bonded) to the same building power distribution ground. Grounding must not rely on flexible cables and should not include any form of plug or socket that would permit inadvertent disconnection. Some local codes may require redundant ground connections. The integrity of all connections should be periodically checked. Refer to the instructions supplied with the filter.

Fuses and Circuit Breakers

The PowerFlex 70 can be installed with either input fuses or an input circuit breaker. National and local industrial safety regulations and/or electrical codes may determine additional requirements for these installations. Refer to Appendix A for recommended fuses/circuit breakers.

ATTENTION: The PowerFlex 70 does not provide branch short circuit protection. Specifications for the recommended fuse or circuit breaker to provide protection against short circuits are provided in Appendix A.

Power Wiring

ATTENTION: National Codes and standards (NEC, VDE, BSI etc.) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

Cable Types Acceptable for 200-600 Volt Installations

A variety of cable types are acceptable for drive installations. For many installations, unshielded cable is adequate, provided it can be separated from sensitive circuits. As an approximate guide, allow a spacing of 0.3 meters (1 foot) for every 10 meters (32.8 feet) of length. In all cases, long parallel runs must be avoided. Do not use cable with an insulation thickness less than or equal to 15 mils (0.4 mm/0.015 in.). See Table 1.A.

Unshielded

THHN, THWN or similar wire is acceptable for drive installation in dry environments provided adequate free air space and/or conduit fill rates limits are provided. **Do not use THHN or similarly coated wire in wet areas**. Any wire chosen must have a minimum insulation thickness of 15 mils and should not have large variations in insulation concentricity.

Shielded/Armored Cable

Shielded cable contains all of the general benefits of multi-conductor cable with the added benefit of a copper braided shield that can contain much of the noise generated by a typical AC Drive. Strong consideration for shielded cable should be given in installations with sensitive equipment such as weigh scales, capacitive proximity switches and other devices that may be affected by electrical noise in the distribution system. Applications with large numbers of drives in a similar location, imposed EMC regulations or a high degree of communications / networking are also good candidates for shielded cable.

Shielded cable may also help reduce shaft voltage and induced bearing currents for some applications. In addition, the increased impedance of shielded cable may help extend the distance that the motor can be located from the drive without the addition of motor protective devices such as terminator networks. Refer to Reflected Wave in “Wiring and Grounding Guidelines for PWM AC Drives,” publication DRIVES-IN001A-EN-P.

Consideration should be given to all of the general specifications dictated by the environment of the installation, including temperature, flexibility, moisture characteristics and chemical resistance. In addition, a braided shield should be included and be specified by the cable manufacturer as having coverage of at least 75%. An additional foil shield can greatly improve noise containment.

A good example of recommended cable is Belden® 295xx (xx determines gauge). This cable has four (4) XLPE insulated conductors with a 100% coverage foil and an 85% coverage copper braided shield (with drain wire) surrounded by a PVC jacket.

Other types of shielded cable are available, but the selection of these types may limit the allowable cable length. Particularly, some of the newer cables twist 4 conductors of THHN wire and wrap them tightly with a foil shield. This construction can greatly increase the cable charging current required and reduce the overall drive performance. Unless specified in the individual distance tables as tested with the drive, these cables are not recommended and their performance against the lead length limits supplied is not known.

Table 1.A Recommended Shielded Wire

Location	Rating/Type	Description
Standard (Option 1)	600V, 90°C (194°F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent	• Four tinned copper conductors with XLPE insulation. • Copper braid/aluminum foil combination shield and tinned copper drain wire. • PVC jacket.
Standard (Option 2)	Tray rated 600V, 90°C (194°F) RHH/RHW-2 Anixter OLF-7xxxxx or equivalent	• Three tinned copper conductors with XLPE insulation. • 5 mil single helical copper tape (25% overlap min.) with three bare copper grounds in contact with shield. • PVC jacket.
Class I & II; Division I & II	Tray rated 600V, 90°C (194°F) RHH/RHW-2 Anixter 7V-7xxxx-3G or equivalent	• Three bare copper conductors with XLPE insulation and impervious corrugated continuously welded aluminum armor. • Black sunlight resistant PVC jacket overall. • Three copper grounds on #10 AWG and smaller.

EMC Compliance

Refer to EMC Instructions on page 1-19 for details.

Cable Trays and Conduit

If cable trays or large conduits are to be used, refer to guidelines presented in the *PowerFlex Reference Manual*.

ATTENTION: To avoid a possible shock hazard caused by induced voltages, unused wires in the conduit must be grounded at both ends. For the same reason, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled. This will help minimize the possible shock hazard from “cross coupled” motor leads.

Motor Cable Lengths

Typically, motor lead lengths less than 30 meters (approximately 100 feet) are acceptable. However, if your application dictates longer lengths, refer to the *PowerFlex Reference Manual* for details.

Power Terminal Block

Figure 1.2 Typical Power Terminal Block Location (B Frame Shown)

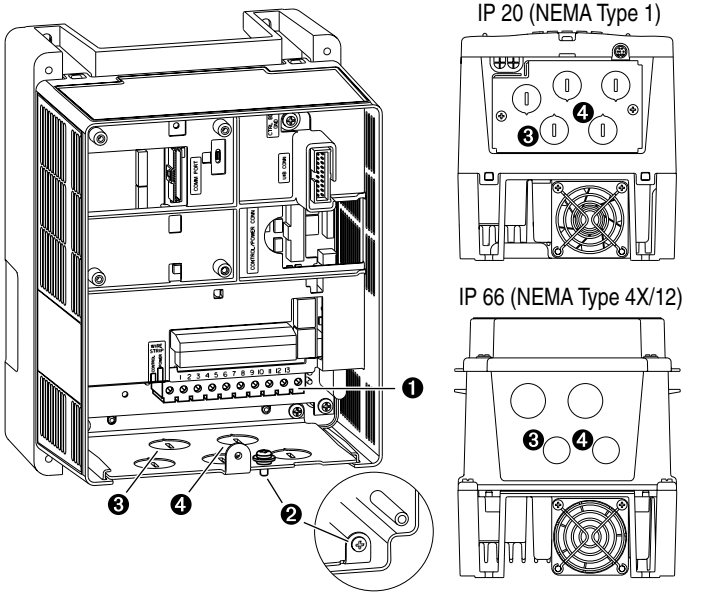


Table 1.B Power Terminal Block Specifications

No.	Name	Description	Frame	Wire Size Range(1)		Torque	
				Maximum	Minimum	Maximum	Recommended
1	Power Terminal Block	Input power and motor connections	A, B, & C	3.5 mm^2 (12 AWG)	0.3 mm^2 (22 AWG)	0.66 N-m (5.5 lb.-in.)	0.6 N-m (5 lb.-in.)
			D	8.4 mm^2 (8 AWG)	0.8 mm^2 (18 AWG)	1.7 N-m (15 lb.-in.)	1.4 N-m (12 lb.-in.)
2	SHLD terminal	Terminating point for wiring shields	All	—	—	1.6 N-m (14 lb.-in.)	1.6 N-m (14 lb.-in.)

(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

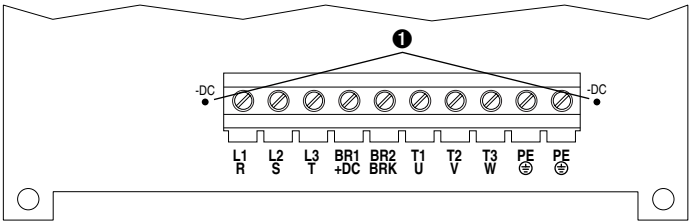
Table 1.C Wire Routing Recommendations

No.	Description
3	Suggested entry for incoming line wiring.
4	Suggested entry for motor wiring.

Cable Entry Plate Removal

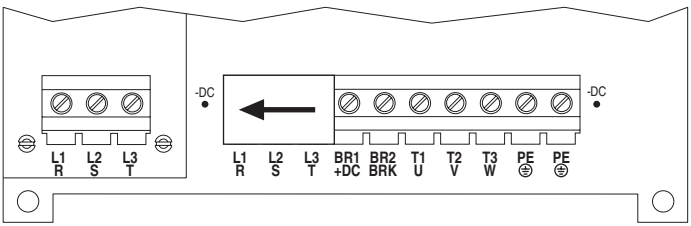
If additional wiring access is needed, the Cable Entry Plate on all drive Frames can be removed. Simply loosen the screws securing the plate to the heat sink and slide the plate out.

Figure 1.3 Power Terminal Block and DC Bus Test Points



Terminal	Description	Notes
R	R (L1)	AC Line Input Power
S	S (L2)	AC Line Input Power
T	T (L3)	AC Line Input Power
+DC	DC Bus (+)	Dynamic Brake Resistor Connection (+)
BRK	DC Brake	Dynamic Brake Resistor Connection (–)
U	U (T1)	To Motor
V	V (T2)	To Motor
W	W (T3)	To Motor
PE	PE Ground	
PE	PE Ground	
-DC	DC Bus (–)	❶ May be located to the left or right of the Power Terminal Block.

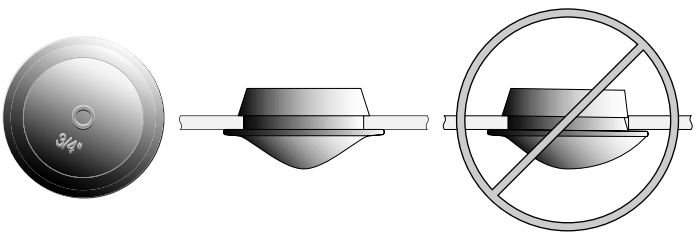
Figure 1.4 Power Input Terminals on the Internal RFI Filter Option



IP66 (NEMA Type 4X/12) Installations

Use the plugs supplied with IP66 (NEMA Type 4X/12) rated drives to seal unused holes in the conduit entry plate.

Important: Completely seat the plug inner rim for the best seal.



Using Input/Output Contactors

Input Contactor Precautions

ATTENTION: A contactor or other device that routinely disconnects and reapplies the AC line to the drive to start and stop the motor can cause drive hardware damage. The drive is designed to use control input signals that will start and stop the motor. If an input device is used, operation must not exceed one cycle per minute or drive damage will occur.

ATTENTION: The drive start/stop/enable control circuitry includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. An auxiliary braking method may be required.

Output Contactor Precaution

ATTENTION: To guard against drive damage when using output contactors, the following information must be read and understood. One or more output contactors may be installed between the drive and motor(s) for the purpose of disconnecting or isolating certain motors/loads. If a contactor is opened while the drive is operating, power will be removed from the respective motor, but the drive will continue to produce voltage at the output terminals. In addition, reconnecting a motor to an active drive (by closing the contactor) could produce excessive current that may cause the drive to fault. If any of these conditions are determined to be undesirable or unsafe, an auxiliary contact on the output contactor should be wired to a drive digital input that is programmed as "Enable." This will cause the drive to execute a coast-to-stop (cease output) whenever an output contactor is opened.

Disconnecting MOVs and Common Mode Capacitors

PowerFlex 70 drives contain protective MOVs and common mode capacitors that are referenced to ground. To guard against drive damage, these devices should be disconnected if the drive is installed on an ungrounded distribution system where the line-to-ground voltages on any phase could exceed 125% of the nominal line-to-line voltage. To disconnect these devices, remove all the jumper(s) shown in the figure and table below. See the *PowerFlex Reference Manual* for more information on ungrounded system installation.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before removing/installing jumpers. Measure the DC bus voltage at the +DC terminal of the Power Terminal Block and the -DC test point. The voltage must be zero.

Figure 1.5 Typical Jumper Locations (C Frame Shown)

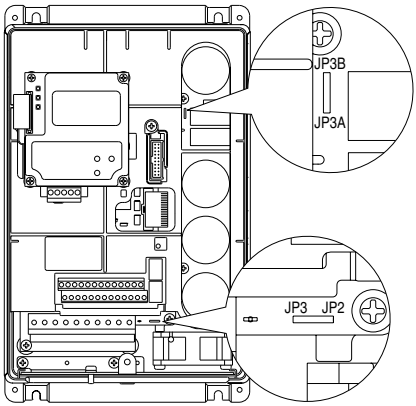
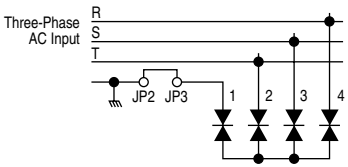
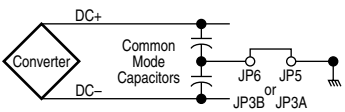


Figure 1.6 Phase to Ground MOV Removal



Frame	Jumper	Removes
A, B, C and D	JP3 – JP2	MOV to Ground

Figure 1.7 Common Mode Capacitors to Ground Removal



Frame	Jumper	Removes
A	N/A	
B	JP6 – JP5	Common Mode Capacitors to Ground
C and D	JP3B – JP3A	Common Mode Capacitors to Ground

I/O Wiring

Important points to remember about I/O wiring:

- Always use copper wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).

Important: I/O terminals labeled "(–)" or "Common" are not referenced to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.

ATTENTION: Configuring an analog input for 0-20mA operation and driving it from a voltage source could cause component damage. Verify proper configuration prior to applying input signals.

ATTENTION: Hazard of personal injury or equipment damage exists when using bipolar input sources. Noise and drift in sensitive input circuits can cause unpredictable changes in motor speed and direction. Use speed command parameters to help reduce input source sensitivity.

Signal and Control Wire Types

Table 1.D Recommended Signal Wire

Signal Type	Wire Type(s)	Description	Minimum Insulation Rating
Analog I/O	Belden 8760/9460 (or equiv.)	0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain (1).	300V, 75-90 degrees C (167-194 degrees F)
	Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 conductor, shielded for remote pot only.	
EMC Compliance	Refer to EMC Instructions on page 1-19 for details.		

(1) If the wires are short and contained within a cabinet which has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.

Table 1.E Recommended Control Wire for Digital I/O

	Wire Type(s)	Description	Minimum Insulation Rating
Unshielded	Per US NEC or applicable national or local code	—	300V, 60 degrees C (140 degrees F)
Shield	Multi-conductor shielded cable such as Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 conductor, shielded.	

I/O Terminal Block

Figure 1.8 Typical I/O Terminal Block Location (B Frame Shown)

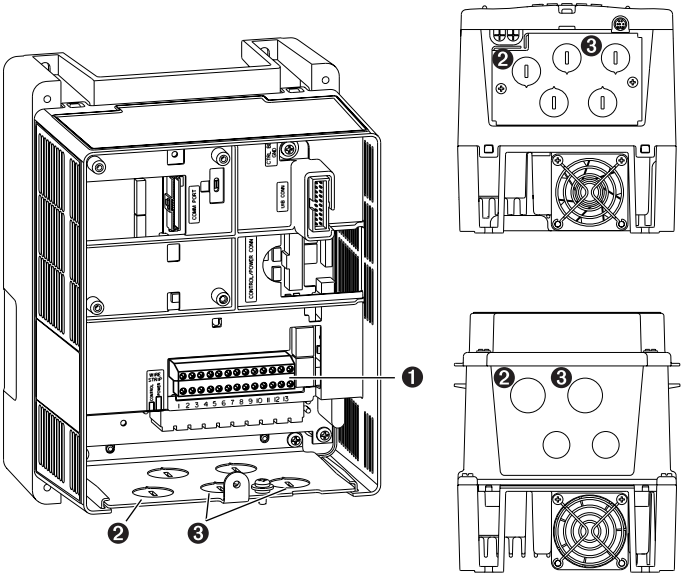


Table 1.F I/O Terminal Block Specifications

No.	Name	Description	Wire Size Range[1]		Torque	
			Maximum	Minimum	Maximum	Recommended
❶	I/O Terminal Block	Signal & control connections	1.5 mm^2 (16 AWG)	0.05 mm^2 (30 AWG)	0.55 N-m (4.9 lb.-in.)	0.5 N-m (4.4 lb.-in.)

(1) Maximum / minimum that the terminal block will accept - these are not recommendations.

Table 1.G Wire Routing Recommendations

No.	Description
❷	Suggested entry for communication wiring.
❸	Suggested entry for I/O and control wiring.

No.	Signal	Factory Default	Description	Related Param.
1	Digital In1 Sel	Stop – CF (CF = Clear Fault)	11.2 mA @ 24V DC 19.2V minimum on state 3.2V maximum off state Important: Use only 24V DC, not suitable for 115V AC circuitry. Inputs can be wired as sink or source. See page 1-15.	361 - 366
2	Digital In2 Sel	Start		
3	Digital In3 Sel	Auto/Man		
4	Digital In4 Sel	Speed Sel 1		
5	Digital In5 Sel	Speed Sel 2		
6	Digital In6 Sel	Speed Sel 3		
7	24V Common	–	Drive supplied power for Digital In1-6 inputs. See examples on page 1-15. 150mA maximum load.	
8	Digital In Common	–		
9	+24V DC	–		
10	+10V Pot Reference	–	2 k ohm minimum load.	
11	Digital Out 1 – N.O.(1)	NOT Fault	Max Resistive Load: 250V AC / 30V DC, 50 VA / 60 Watts Max Inductive Load: 250V AC / 30V DC, 25 VA / 30 Watts Minimum DC Load: 10 µA, 10 mV DC	380 - 387
12	Digital Out 1 Common			
13	Digital Out 1 – N.C.(1)	Fault		
14	Analog In 1 (– Volts)	(2) Voltage – Reads value at 14 & 15	Non-isolated, 0 to +10V, 10 bit, 100k ohm input impedance.(3)	320 - 327
15	Analog In 1 (+ Volts)			
16	Analog In 1 (– Current)		Non-isolated, 4-20mA, 10 bit, 100 ohm input impedance.(3)	
17	Analog In 1 (+ Current)			
18	Analog In 2 (– Volts)	(2) Voltage – Reads value at 18 & 19	Isolated, bipolar, differential, 0 to +10V unipolar (10 bit) or ±10V bipolar (10 bit & sign), 100k ohm input impedance.(4)	
19	Analog In 2 (+ Volts)			
20	Analog In 2 (– Current)		Isolated, 4-20mA, 10 bit & sign, 100 ohm input impedance.(4)	
21	Analog In 2 (+ Current)			
22	Analog Out (– Volts) 10V Pot Common	(2) Output Freq	0 to +10V, 10 bit, 10k ohm (2k ohm minimum) load. Referenced to chassis ground. Common if internal 10V supply (terminal 10) is used.	341 - 344
23	Analog Out (+ Volts)			
24	Digital Out 2 – N.O.(1)	Run	See description at No.s 11-13.	380 - 387
25	Digital Out 2 Common			
26	Digital Out 2 – N.C.(1)	NOT Run		

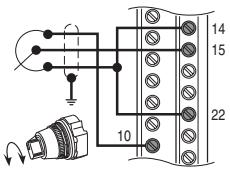
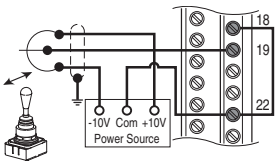
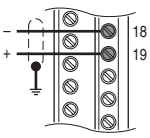
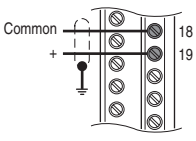
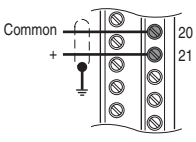
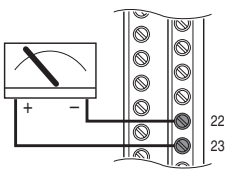
(1) Contacts shown in unpowered state. Any relay programmed as Fault or Alarm will energize (pick up) when power is applied to drive and deenergize (drop out) when fault or alarm exists. Relays selected for other functions will energize only when that condition exists and will deenergize when condition is removed.

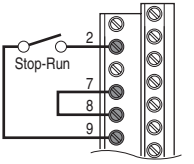
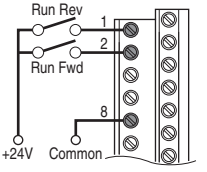
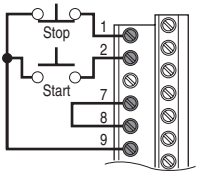
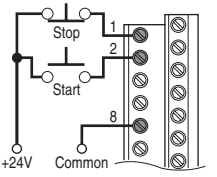
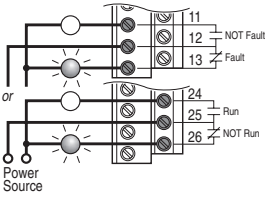
(2) These inputs/outputs are dependent on a number of parameters. See “Related Parameters.”

(3) Differential Isolation - External source must be less than 10V with respect to PE.

(4) Differential Isolation - External source must be maintained at less than 160V with respect to PE. Input provides high common mode immunity.

I/O Wiring Examples

Input/Output	Connection Example	Required Parameter Settings
Potentiometer Unipolar Speed Reference 10k Ohm Pot. Recommended (2k Ohm minimum)		Select Speed Reference source: Param. 090 = 1 “Analog In 1” Adjust Scaling: Param. 091, 092, 322, 323 Check Results: Param. 016
Joystick Bipolar Speed Reference ±10V Input		Set Direction Mode: Param. 190 = 1 “Bipolar” Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017
Analog Input Bipolar Speed Reference ±10V Input		Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017
Analog Input Unipolar Speed Reference 0 to +10V Input		Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017
Analog Input Unipolar Speed Reference 4-20 mA Input		Configure Input for Current: Param. 320, Bit #1 = 1 “Current” Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017
Analog Output Unipolar 0 to +10V Output. Can Drive a 2k Ohm load (25 mA short circuit limit)		Select Source Value: Param. 342 Adjust Scaling: Param. 343, 344

Input/Output	Connection Example	Required Parameter Settings
2 Wire Control Non-Reversing	Internal Supply 	Disable Digital Input 1: Param. 361 = 0 “Not Used” Set Digital Input 2: Param. 362 = 7 “Run”
2 Wire Control Reversing	External Supply 	Set Digital Input 1: Param. 361 = 9 “Run Reverse” Set Digital Input 2: Param. 362 = 8 “Run Forward”
3 Wire Control	Internal Supply 	Use factory default parameter settings.
3 Wire Control	External Supply 	Use factory default parameter settings.
Digital Output Form C Relays Energized in Normal State.		Select Source: Param. 380, 384

Speed Reference Control

"Auto" Speed Sources

The drive speed command can be obtained from a number of different sources. The source is determined by drive programming and the condition of the Speed Select digital inputs, Auto/Manual digital inputs or reference select bits of a command word.

The default source for a command reference (all speed select inputs open or not programmed) is the selection programmed in [Speed Ref A Sel]. If any of the speed select inputs are closed, the drive will use other parameters as the speed command source.

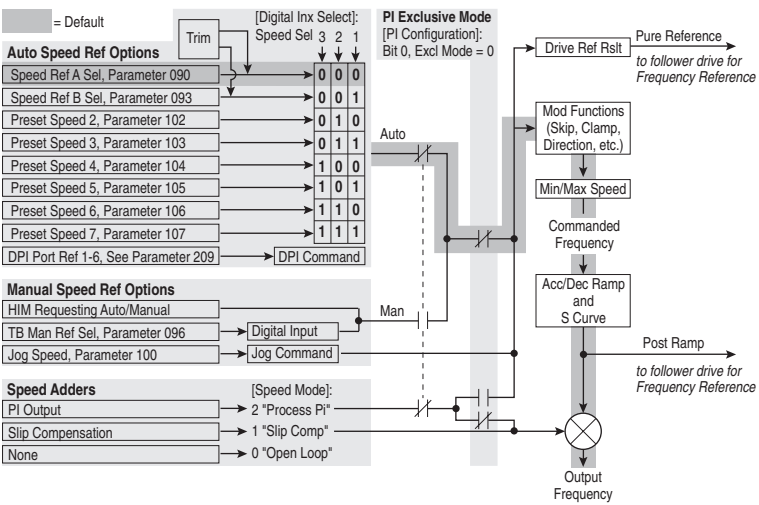
"Manual" Speed Sources

The manual source for speed command to the drive is either the HIM requesting manual control (see ALT Functions on page B-2) or the control terminal block (analog input) if a digital input is programmed to "Auto/Manual".

Changing Speed Sources

The selection of the active Speed Reference can be made through digital inputs, DPI command, jog button or Auto/Manual HIM operation.

Figure 1.9 Speed Reference Selection Chart (1)



(1) To access Preset Speed 1, set [Speed Ref A Sel] or [Speed Ref B Sel] to "Preset Speed 1".

Auto/Manual Examples

PLC = Auto, HIM = Manual

A process is run by a PLC when in Auto mode and requires manual control from the HIM during set-up. The Auto speed reference is issued by the PLC through a communications module installed in the drive. Since the internal communications is designated as Port 5, [Speed Ref A Sel] is set to “DPI Port 5” with the drive running from the Auto source.

Attain Manual Control

- Press ALT then Auto/Man on the HIM.
  When the HIM attains manual control, the drive speed command comes from the HIM speed control keys or analog potentiometer.

Release to Auto Control

- Press ALT then Auto/Man on the HIM again.
  When the HIM releases manual control, the drive speed command returns to the PLC.

PLC = Auto, Terminal Block = Manual

A process is run by a PLC when in Auto mode and requires manual control from an analog potentiometer wired to the drive terminal block. The auto speed reference is issued by the PLC through a communications module installed in the drive. Since the internal communications is designated as Port 5, [Speed Ref A Sel] is set to “DPI Port 5” with the drive running from the Auto source. Since the Manual speed reference is issued by an analog input (“Analog In 1 or 2”), [TB Man Ref Sel] is set to the same input. To switch between Auto and Manual, [Digital In4 Sel] is set to “Auto/ Manual”.

Attain Manual Control

- Close the digital input.
  With the input closed, the speed command comes from the potentiometer.

Release to Auto Control

- Open the digital input.
  With the input open, the speed command returns to the PLC.

Auto/Manual Notes

1. Manual control is exclusive. If a HIM or Terminal Block takes manual control, no other device can take manual control until the controlling device releases manual control.
2. If a HIM has manual control and power is removed from the drive, the drive will return to Auto mode when power is reapplied.

EMC Instructions

CE Conformity

Conformity with the Low Voltage (LV) Directive and Electromagnetic Compatibility (EMC) Directive has been demonstrated using harmonized European Norm (EN) standards published in the Official Journal of the European Communities. PowerFlex Drives comply with the EN standards listed below when installed according to the User and Reference Manuals.

CE Declarations of Conformity are available online at: **http://www.ab.com/certification/ce/docs**.

Low Voltage Directive (73/23/EEC)

- EN50178 Electronic equipment for use in power installations

EMC Directive (89/336/EEC)

- EN61800-3 Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods.

General Notes

- If the adhesive label is removed from the top of the drive, the drive must be installed in an enclosure with side openings less than 12.5 mm (0.5 in.) and top openings less than 1.0 mm (0.04 in.) to maintain compliance with the LV Directive.
- The motor cable should be kept as short as possible in order to avoid electromagnetic emission as well as capacitive currents.
- Use of line filters in ungrounded systems is not recommended.
- PowerFlex drives may cause radio interference if used in a residential or domestic environment. The user is required to take measures to prevent interference, in addition to the essential requirements for CE compliance listed below, if necessary.
- Conformity of the drive with CE EMC requirements does not guarantee an entire machine or installation complies with CE EMC requirements. Many factors can influence total machine/installation compliance.
- PowerFlex drives can generate conducted low frequency disturbances (harmonic emissions) on the AC supply system. More information regarding harmonic emissions can be found in the *PowerFlex Reference Manual*.

Essential Requirements for CE Compliance

Conditions 1-6 listed below **must be** satisfied for PowerFlex drives to meet the requirements of **EN61800-3**.

1. Standard PowerFlex 70 CE compatible Drive.
2. Review important precautions/attention statements throughout this manual before installing the drive.
3. Grounding as described on page 1-5.
4. Output power, control (I/O) and signal wiring must be braided, shielded cable with a coverage of 75% or better, metal conduit or equivalent attenuation.
5. All shielded cables should terminate with the proper shielded connector.
6. Conditions in Table 1.H.

Table 1.H PowerFlex 70 EN61800-3 EMC Compatibility

Frame	Drive Description	Second Environment				First Environment Restricted Distribution
		Restrict Motor Cable to 40 m (131 ft.)	Internal Filter Option	External Filter	Input Ferrite (1)	
A	Drive Only	✔		✔		Refer to *PowerFlex Reference Manual*
	with any Comm Option	✔		✔		
	with ControlNet	✔		✔	✔	
B	Drive Only	✔	✔			
	with any Comm Option	✔	✔			
	with ControlNet	✔	✔		✔	
C	Drive Only	✔				
	with any Comm Option	✔				
	with ControlNet	✔			✔	
D	Drive Only	✔				
	with any Comm Option	✔				
	with ControlNet	✔			✔	

(1) Input cables through a Ferrite Core (Frames A, B and C Fair-Rite #2643102002 or equivalent, Frame D Fair-Rite #2643251002 or equivalent).

Start Up

This chapter describes how you start up the PowerFlex 70 Drive. Refer to Appendix B for a brief description of the LED and LCD HIM (Human Interface Module).

For information on...	See page
Prepare For Drive Start-Up	2-1
Status Indicators	2-2
Start-Up Routines	2-3

For information on...	See page
Running S.M.A.R.T. Start	2-4
Running an Assisted Start Up	2-4

ATTENTION: Power must be applied to the drive to perform the following start-up procedure. Some of the voltages present are at incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Thoroughly read and understand the procedure before beginning. If an event does not occur while performing this procedure, **Do Not Proceed**. **Remove Power** including user supplied control voltages. User supplied voltages may exist even when main AC power is not applied to the drive. Correct the malfunction before continuing.

Prepare For Drive Start-Up

Before Applying Power to the Drive

❑ **1.** Confirm that all inputs are connected to the correct terminals and are secure.

❑ **2.** Verify that AC line power at the disconnect device is within the rated value of the drive.

❑ **3.** Verify that control power voltage is correct.

The remainder of this procedure requires that a HIM be installed. If an operator interface is not available, remote devices should be used to start up the drive.

Applying Power to the Drive

❑ **4.** Apply AC power and control voltages to the drive.

If any of the six digital inputs are configured to "Stop – CF" (CF = Clear Fault) or "Enable," verify that signals are present or the drive will not start. Refer to Alarm Descriptions on page 4-7 for a list of potential digital input conflicts.

If a fault code appears, refer to Chapter 4.

If the STS LED is not flashing green at this point, refer to Status Indicators and their indications below.

❑ **5.** Proceed to Start-Up Routines.

Status Indicators

Figure 2.1 Drive Status Indicators (Typical)

#	Name	Color	State	Description
❶	STS (Status)	Green	Flashing	Drive ready, but not running and no faults are present.
			Steady	Drive running, no faults are present.
		Yellow See page 4-7	Flashing, Drive Stopped	A type 2 alarm condition exists, the drive cannot be started. Check parameter 212 [Drive Alarm 2].
			Flashing, Drive Running	An intermittent type 1 alarm condition is occurring. Check parameter 211 [Drive Alarm 1].
			Steady, Drive Running	A continuous type 1 alarm condition exists. Check parameter 211 [Drive Alarm 1].
		Red See page 4-3	Flashing	A fault has occurred.
			Steady	A non-resetable fault has occurred.
❷	PORT	Refer to the Communication Adapter User Manual.		Status of DPI port internal communications (if present).
	MOD			Status of communications module (when installed).
	NET A			Status of network (if connected).
	NET B			Status of secondary network (if connected).

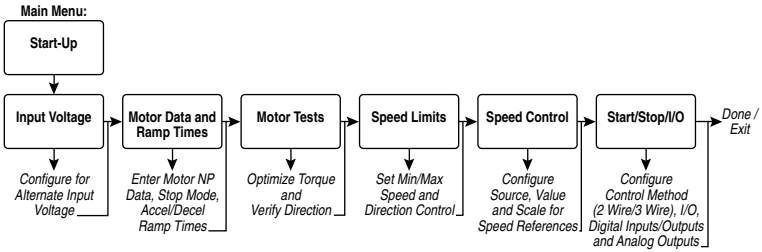
Start-Up Routines

The PowerFlex 70 is designed so that start up is simple and efficient. If you have an LCD HIM, two start-up methods are provided, allowing the user to select the desired level needed for the application.

- **S.M.A.R.T. Start**
  This routine allows you to quickly set up the drive by programming values for the most commonly used functions (see below).

- **Assisted Start Up**
  This routine prompts you for information that is needed to start up a drive for most applications, such as line and motor data, commonly adjusted parameters and I/O.

Figure 2.2 Start Up Menu


Main Menu:
Start-Up
Input Voltage
Motor Data and Ramp Times
Motor Tests
Speed Limits
Speed Control
Start/Stop/I/O
Done / Exit
Configure for Alternate Input Voltage
Enter Motor NP Data, Stop Mode, Accel/Decel Ramp Times
Optimize Torque and Verify Direction
Set Min/Max Speed and Direction Control
Configure Source, Value and Scale for Speed References
Configure Control Method (2 Wire/3 Wire), I/O, Digital Inputs/Outputs and Analog Outputs

If you do not have an LCD HIM, you must set parameters individually using the LED HIM or other configuration tools, Refer to Chapter 3 for parameters.

Important: Power must be applied to the drive when viewing or changing parameters. Previous programming may affect the drive status when power is applied.

Running S.M.A.R.T. Start

During a Start Up, the majority of applications require changes to only a few parameters. The LCD HIM on a PowerFlex 70 drive offers S.M.A.R.T. start, which displays the most commonly changed parameters. With these parameters, you can set the following functions:

S - Start Mode and Stop Mode
M - Minimum and Maximum Speed
A - Accel Time 1 and Decel Time 1
R - Reference Source
T - Thermal Motor Overload

To run a S.M.A.R.T. start routine:

Step	Key(s)	Example LCD Displays
1. Press ALT and then Esc (S.M.A.R.T). The S.M.A.R.T. start screen appears. 2. View and change parameter values as desired. For HIM information, see Appendix B. 3. Press Esc to exit the S.M.A.R.T. start.	ALT Esc Esc	F-> Stopped Auto SMART List: Digital In2 Sel Stop Mode A Minimum Speed

Running an Assisted Start Up

Important: This start-up routine requires an LCD HIM.

The Assisted start-up routine asks simple yes or no questions and prompts you to input required information. Access Assisted Start Up by selecting “Start Up” from the Main Menu.

To perform an Assisted Start-Up

Step	Key(s)	Example LCD Displays
1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to “Start Up”. 2. Press Enter.	▲ ▼ ↵	F-> Stopped Auto 0.0 Hz Main Menu: Memory Storage Start Up Preferences

Programming and Parameters

Chapter 3 provides a complete listing and description of the PowerFlex 70 parameters. The parameters can be programmed (viewed/edited) using an LED or LCD HIM (Human Interface Module). As an alternative, programming can also be performed using DriveExplorer™ or DriveExecutive™ software and a personal computer. Refer to Appendix B for brief descriptions of the LED and LCD Human Interface Modules.

For information on…	See page…
About Parameters	3-1
How Parameters are Organized	3-3
Monitor File (File A)	3-8
Motor Control File (File B)	3-9
Speed Command File (File C)	3-12
Dynamic Control File (File D)	3-18
Utility File (File E)	3-23
Communication File (File H)	3-31
Inputs & Outputs File (File J)	3-35
Parameter Cross Reference – by Name	3-39

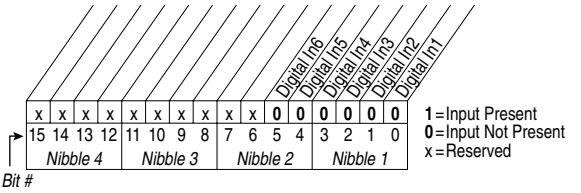
About Parameters

To configure a drive to operate in a specific way, drive parameters may have to be set. Three types of parameters exist:

- **ENUM Parameters**
  ENUM parameters allow a selection from 2 or more items. The LCD HIM will display a text message for each item. The LED HIM will display a number for each item.
- **Bit Parameters**
  Bit parameters have individual bits associated with features or conditions. If the bit is 0, the feature is off or the condition is false. If the bit is 1, the feature is on or the condition is true.
- **Numeric Parameters**
  These parameters have a single numerical value (i.e. 0.1 Volts).

The example on the following page shows how each parameter type is presented in this manual.

❶ File E	❷ Group	❸ No.	❹ Parameter Name and Description	❺ Values			❻ Related
UTILITY (File E)	Drive...	198	**[Load Frm Usr Set]** Loads a previously saved set of parameter values from a selected user set location in drive nonvolatile memory to active drive memory.	Default: Options:	0 0 1 2 3	"Ready" "Ready" "User Set 1" "User Set 2" "User Set 3"	199
	Diagnostics	216	**[Dig In Status]** Status of the digital inputs.				
		218	**[Drive Temp]** Present operating temperature of the drive power section.	Default: Min/Max: Units:	Read Only 0.0/100.0% 0.1%		


Digital In6
Digital In5
Digital In4
Digital In3
Digital In2
Digital In1
x x x x x x x x x x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Input Present
0 = Input Not Present
x = Reserved

No.	Description		
❶	**File** – Lists the major parameter file category.		
❷	**Group** – Lists the parameter group within a file.		
❸	**No.** – Parameter number. = Stop drive before changing this parameter. = 32 bit parameter.		
❹	**Parameter Name and Description** – Parameter name as it appears on an LCD HIM, with a brief description of the parameter's function.		
❺	**Values** – Defines the various operating characteristics of the parameter. Three types exist.		
	ENUM	Default:	Lists the value assigned at the factory. "Read Only" = no default.
		Options:	Displays the programming selections available.
	Bit	Bit #:	Lists the bit place holder and definition for each bit.
	Numeric	Default:	Lists the value assigned at the factory. "Read Only" = no default.
		Min/Max: Units:	The range (lowest and highest setting) possible for the parameter. Unit of measure and resolution as shown on the LCD HIM. **Important:** When sending values through DPI ports, simply remove the decimal point to arrive at the correct value (i.e. to send "5.00 Hz," use "500").
❻	**Related** – Lists parameters (if any) that interact with the selected parameter. The symbol "i" indicates that additional parameter information is available in Appendix C.		

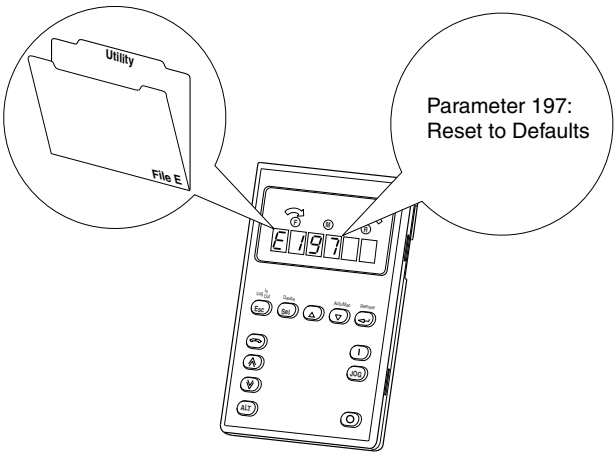
How Parameters are Organized

LED HIM (Human Interface Module)

The LED HIM displays parameters in **Linear** order. Parameters are accessed by first selecting the file letter then a parameter number.

File Letter Designations

The LED HIM identifies each parameter by File Letter and Parameter Number.



LCD HIM (Human Interface Module)

The LCD HIM displays parameters in a **File-Group-Parameter** or **Numbered List** view order. To switch display mode, access the Main Menu, press ALT then Sel while cursor is on the parameter selection. In addition, using 196 [Param Access Lvl], the user has the option to display *all* parameters, commonly used parameters or diagnostic parameters.

File-Group-Parameter View

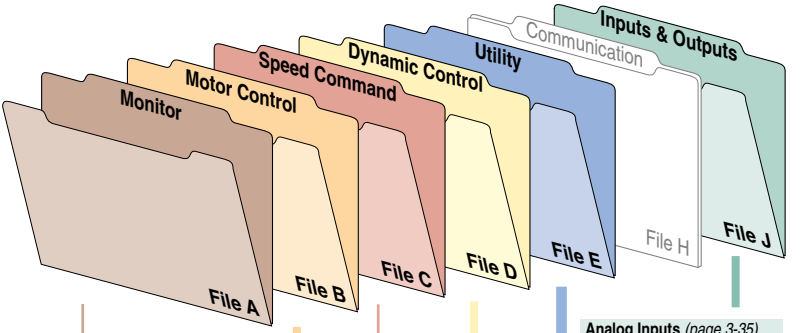
This simplifies programming by grouping parameters that are used for similar functions. The parameters are organized into 6 files in Basic Parameter view or 7 files in Advanced Parameter view. Each file is divided into groups, and each parameter is an element in a group. By default, the LCD HIM displays parameters by File-Group-Parameter view.

Numbered List View

All parameters are in numerical order.

Basic Parameter View

(Parameter 196 [Param Access Lvl] set to option 0 “Basic.”)



Metering *(page 3-8)*

Output Freq	001
Commanded Freq	002
Output Current	003
DC Bus Voltage	012

Motor Data *(page 3-9)*

Motor NP Volts	041
Motor NP FLA	042
Motor NP Hertz	043
Motor NP RPM	044
Motor NP Power	045
Mtr NP Pwr Units	046
Motor OL Hertz	047

Torq Attributes *(page 3-10)*

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Maximum Freq	055
Autotune	061

Spd Mode & Limits *(page 3-12)*

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Digital In1-6 Sel	361-366

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Dig Out1, 2 Level	381, 385

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Direction Mode	190

Drive Memory *(page 3-24)*

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Load Frm Usr Set	198
Save To User Set	199
Language	201

Faults *(page 3-29)*

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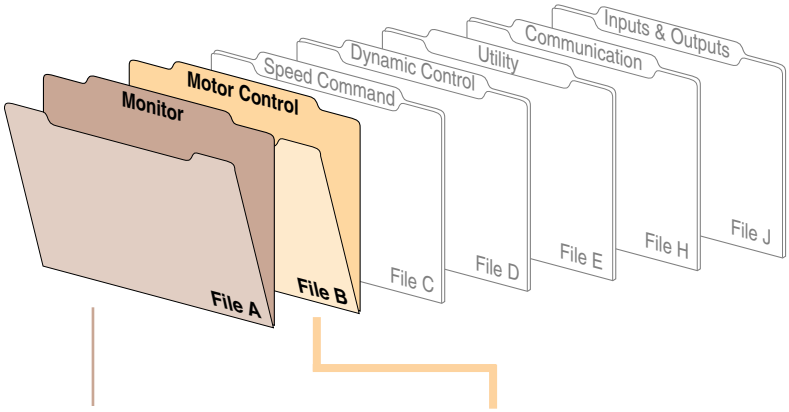
Advanced Parameter View

(Parameter 196 [Param Access Lvl] set to option 1 “Advanced.”)



Metering *(page 3-8)*	
Output Freq	001
Commanded Freq	002
Output Current	003
Torque Current	004
Flux Current	005
Output Voltage	006
Output Power	007
Output Powr Fctr	008
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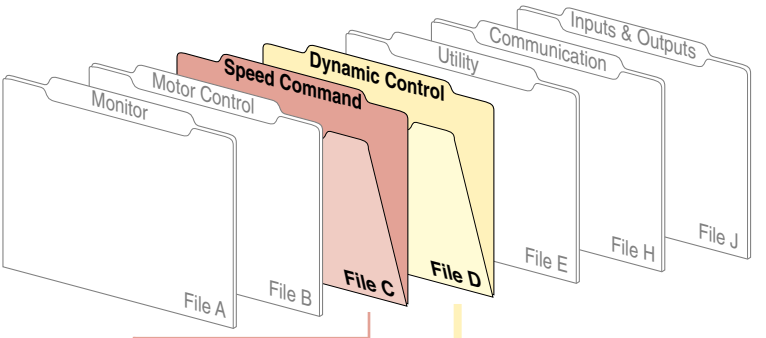

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Speed Ref B Hi	094
Speed Ref B Lo	095
TB Man Ref Sel	096
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DC Brake Level	158
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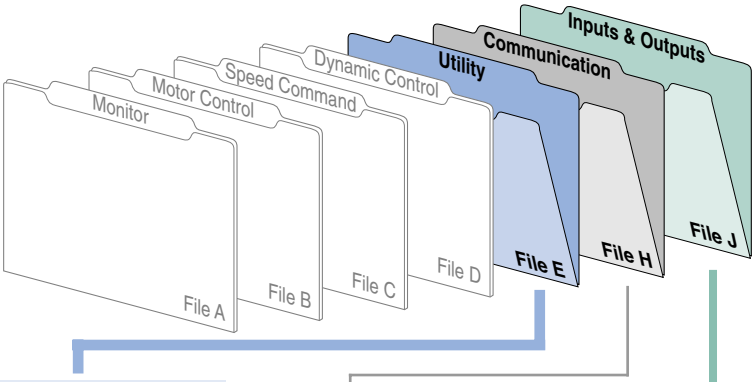

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Accel Owner	293
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Digital Outputs *(page 3-38)*

Digital Out1, 2 Sel	380, 384
Dig Out1, 2 Level	381, 385
Dig Out1, 2 OnTime	382, 386
Dig Out1, 2 OffTime	383, 387

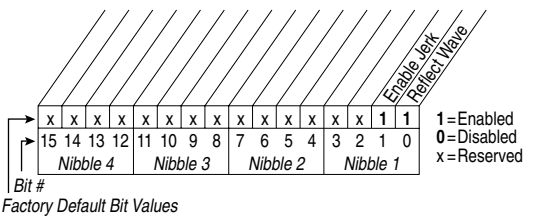
Monitor File (File A)

File A	Group	No.	Parameter Name and Description	Values	Related
MONITOR (File A)	Metering	001	**[Output Freq]** Output frequency present at T1, T2 & T3 (U, V & W)	Default: Read Only Min/Max: –/+[Maximum Freq] Units: 0.1 Hz	
		002	**[Commanded Freq]** Value of the active frequency command.	Default: Read Only Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	
		003	**[Output Current]** The total output current present at T1, T2 & T3 (U, V & W).	Default: Read Only Min/Max: 0.0/Drive Rated Amps × 2 Units: 0.1 Amps	
		004	**[Torque Current]** The amount of current that is in phase with the fundamental voltage component.	Default: Read Only Min/Max: Drive Rating × –2/+2 Units: 0.1 Amps	
		005	**[Flux Current]** The amount of current that is out of phase with the fundamental voltage component.	Default: Read Only Min/Max: Drive Rating × –2/+2 Units: 0.1 Amps	
		006	**[Output Voltage]** Output voltage present at terminals T1, T2 & T3 (U, V & W).	Default: Read Only Min/Max: 0.0/Drive Rated Volts Units: 0.1 VAC	
		007	**[Output Power]** Output power present at T1, T2 & T3 (U, V & W).	Default: Read Only Min/Max: 0.0/Drive Rated kW × 2 Units: 0.1 kW	
		008	**[Output Powr Fctr]** Output power factor.	Default: Read Only Min/Max: 0.00/1.00 Units: 0.01	
		009	**[Elapsed MWh]** ▽32▽ Accumulated output energy of the drive.	Default: Read Only Min/Max: 0.0/429,496,729.5 MWh Units: 0.1 MWh	
		010	**[Elapsed Run Time]** ▽32▽ Accumulated time drive is outputting power.	Default: Read Only Min/Max: 0.0/429,496,729.5 Hrs Units: 0.1 Hrs	
		011	**[MOP Frequency]** Value of the signal at MOP (Motor Operated Potentiometer).	Default: Read Only Min/Max: –/+[Maximum Frequency] Units: 0.1 Hz	
		012	**[DC Bus Voltage]** Present DC bus voltage level.	Default: Read Only Min/Max: 0.0/Based on Drive Rating Units: 0.1 VDC	
		013	**[DC Bus Memory]** 6 minute average of DC bus voltage level.	Default: Read Only Min/Max: 0.0/Based on Drive Rating Units: 0.1 VDC	
		016 017	**[Analog In1 Value]** **[Analog In2 Value]** Value of the signal at the analog inputs.	Default: Read Only Min/Max: 0.000/20.000 mA –/+10.000V Units: 0.001 mA 0.001 Volt	

File A	Group	No.	Parameter Name and Description	Values	Related
MONITOR (File A)	Drive Data	026	**[Rated kW]** 32 Drive power rating.	Default: Read Only Min/Max: 0.37/15.0 kW Units: 0.01 kW	
		027	**[Rated Volts]** The drive input voltage class (208, 240, 400 etc.).	Default: Read Only Min/Max: 208/600 Volt Units: 0.1 VAC	
		028	**[Rated Amps]** The drive rated output current.	Default: Read Only Min/Max: 1.1/32.2 Amps Units: 0.1 Amps	
		029	**[Control SW Ver]** Main Control Board software version.	Default: Read Only Min/Max: 0.000/65.256 Units: 0.001	196

Motor Control File (File B)

File B	Group	No.	Parameter Name and Description	Values	Related
MOTOR CONTROL (File B)	Motor Data	040	**[Motor Type]** Set to match the type of motor connected.	Default: 0 "Induction" Options: 0 "Induction" 1 "Synchr Reluc" 2 "Synchr PM"	
		041	**[Motor NP Volts]** Set to the motor nameplate rated volts.	Default: Based on Drive Rating Min/Max: 0.0/[Rated Volts] Units: 0.1 VAC	
		042	**[Motor NP FLA]** Set to the motor nameplate rated full load amps.	Default: Based on Drive Rating Min/Max: 0.0/[Rated Amps] × 2 Units: 0.1 Amps	047 048
		043	**[Motor NP Hertz]** Set to the motor nameplate rated frequency.	Default: Based on Drive Cat. No. Min/Max: 5.0/400.0 Hz Units: 0.1 Hz	
		044	**[Motor NP RPM]** Set to the motor nameplate rated RPM.	Default: 1750 RPM Min/Max: 60/24000 RPM Units: 1 RPM	
		045	**[Motor NP Power]** Set to the motor nameplate rated power. 32	Default: Based on Drive Rating Min/Max: 0.00/100.00 Units: 0.01 kW/HP See [Mtr NP Pwr Units]	046
		046	**[Mtr NP Pwr Units]** Selects the motor power units to be used.	Default: Based on Drive Rating Options: 0 "Horsepower" 1 "kiloWatts"	

File B	Group	No.	Parameter Name and Description	Values	Related
MOTOR CONTROL (File B)	Motor Data	047	**[Motor OL Hertz]** Selects the output frequency below which the motor operating current is derated. The motor thermal overload will generate a fault at lower levels of current.	Default: Motor NP Hz/3 Min/Max: 0.0/Motor NP Hz Units: 0.1 Hz	042 220
		048	**[Motor OL Factor]** Sets the operating level for the motor overload. Motor FLA x OL Factor = Operating Level	Default: 1.00 Min/Max: 0.20/2.00 Units: 0.01	042 220
	Torq Attributes	053	**[Torque Perf Mode]** Sets the method of motor torque production.	Default: 0 "Sensrls Vect" Options: 0 "Sensrls Vect" 1 "SV Economize" 2 "Custom V/Hz" 3 "Fan/Pmp V/Hz"	062 063 069 070
		054	**[Maximum Voltage]** Sets the highest voltage the drive will output.	Default: Drive Rated Volts Min/Max: Rated Volts × 0.25/Rated Volts Units: 0.1 VAC	
		055	**[Maximum Freq]** Sets the highest frequency the drive will output. Refer to parameter 083 [Overspeed Limit].	Default: 110.0 or 130.0 Hz Min/Max: 5.0/400.0 Hz Units: 0.1 Hz	083
		056	**[Compensation]** Enables/disables correction options.  *Factory Default Bit Values*	
		057	**[Flux Up Mode]** Auto = Flux is established for a calculated time period based on motor nameplate data. [Flux Up Time] is not used. Manual = Flux is established for [Flux Up Time] before acceleration.	Default: 0 "Manual" Options: 0 "Manual" 1 "Automatic"	053 058
		058	**[Flux Up Time]** Sets the amount of time the drive will use to try and achieve full motor stator flux. When a Start command is issued, DC current at current limit level is used to build stator flux before accelerating.	Default: 0.00 Secs Min/Max: 0.00/5.00 Secs Units: 0.01 Secs	053 058

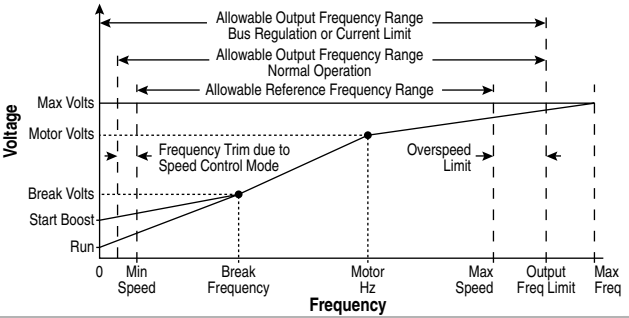
File B	Group	No.	Parameter Name and Description	Values			Related
MOTOR CONTROL (File B)	Torq Attributes	061	**[Autotune]** Provides a manual or automatic method for setting [IR Voltage Drop] and [Flux Current Ref], which affect sensorless vector performance. Valid only when parameter 53 is set to "Sensrls Vect" or "SV Economize."	Default: Options:	3 0 1 2 3	"Calculate" "Ready" "Static Tune" "Rotate Tune" "Calculate"	053 062
			"Ready" (0) = Parameter returns to this setting following a "Static Tune" or "Rotate Tune." It also permits manually setting [IR Voltage Drop] and [Flux Current Ref]. "Static Tune" (1) = A temporary command that initiates a non-rotational motor stator resistance test for the best possible automatic setting of [IR Voltage Drop]. A start command is required following initiation of this setting. The parameter returns to "Ready" (0) following the test, at which time another start transition is required to operate the drive in normal mode. Used when motor cannot be rotated. "Rotate Tune" (2) = A temporary command that initiates a "Static Tune" followed by a rotational test for the best possible automatic setting of [Flux Current Ref]. A start command is required following initiation of this setting. The parameter returns to "Ready" (0) following the test, at which time another start transition is required to operate the drive in normal mode. **Important:** Used when motor is uncoupled from the load. Results may not be valid if a load is coupled to the motor during this procedure. **ATTENTION:** Rotation of the motor in an undesired direction can occur during this procedure. To guard against possible injury and/or equipment damage, it is recommended that the motor be disconnected from the load before proceeding. "Calculate" (3) = This setting uses motor nameplate data to automatically set [IR Voltage Drop] and [Flux Current Ref].				
		062	**[IR Voltage Drop]** Value of voltage drop across the resistance of the motor stator at rated motor current. Used only parameter 53 is set to "Sensrls Vect" or "SV Economize."	Default: Min/Max: Units:	Based on Drive Rating 0.0/[Motor NP Volts]×0.25 0.1 VAC		053 061
		063	**[Flux Current Ref]** 32 Value of amps for full motor flux. Used only when parameter 53 is set to "Sensrls Vect" or "SV Economize."	Default: Min/Max: Units:	Based on Drive Rating 0.00/[Motor NP FLA] 0.01 Amps		053 061

File B	Group	No.	Parameter Name and Description	Values	Related
MOTOR CONTROL (File B)	Volts per Hertz	069	**[Start/Acc Boost]** Sets the voltage boost level for starting and acceleration when "Custom V/Hz" mode is selected. Refer to parameter 083 [Overspeed Limit].	Default: Based on Drive Rating Min/Max: 0.0/[Motor NP Volts] × 0.25 Units: 0.1 VAC	053 070
		070	**[Run Boost]** Sets the boost level for steady state or deceleration when "Fan/Pmp V/Hz" or "Custom V/Hz" modes are selected. Refer to parameter 083 [Overspeed Limit].	Default: Based on Drive Rating Min/Max: 0.0/[Motor NP Volts] × 0.25 Units: 0.1 VAC	053 069
		071	**[Break Voltage]** Sets the voltage the drive will output at [Break Frequency]. Refer to parameter 083 [Overspeed Limit].	Default: [Motor NP Volts] × 0.25 Min/Max: 0.0/[Motor NP Volts] Units: 0.1 VAC	053 072
		072	**[Break Frequency]** Sets the frequency the drive will output at [Break Voltage]. Refer to parameter 083 [Overspeed Limit].	Default: [Motor NP Hertz] × 0.25 Min/Max: 0.0/[Maximum Freq] Units: 0.1 Hz	053 071

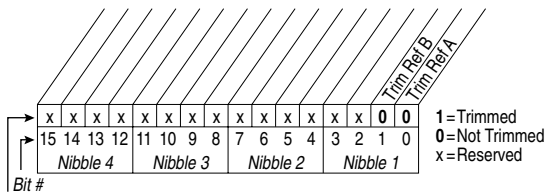
Speed Command File (File C)

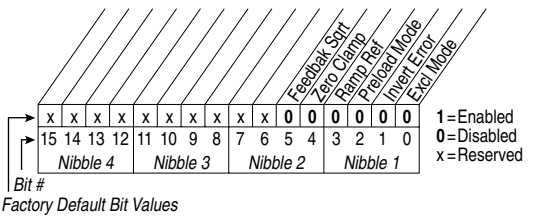
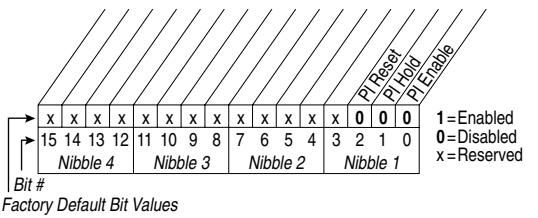
File C	Group	No.	Parameter Name and Description	Values	Related
SPEED COMMAND (File C)	Spd Mode & Limits	080	**[Speed Mode]** Sets the method of speed regulation.	Default: 0 "Open Loop" Options: 0 "Open Loop" 1 "Slip Comp" 2 "Process PI"	121 thru 138
		081	**[Minimum Speed]** Sets the low limit for speed reference after scaling is applied. Refer to parameter 083 [Overspeed Limit].	Default: 0.0 Hz Min/Max: 0.0/[Maximum Speed] Units: 0.1 Hz	092 095
		082	**[Maximum Speed]** Sets the high limit for speed reference after scaling is applied. Refer to parameter 083 [Overspeed Limit].	Default: 50.0 or 60.0 Hz (Dependent on voltage class) Min/Max: 5.0/400.0 Hz Units: 0.1 Hz	055 083 091 094 202

File C	Group	No.	Parameter Name and Description	Values	Related
SPEED COMMAND (File C)	Spd Mode & Limits	083	**[Overspeed Limit]** Sets the incremental amount of the output frequency (above [Maximum Speed]) allowable for functions such as slip compensation. [Maximum Speed] + [Overspeed Limit] must be ≤ [Maximum Freq]	Default: 10.0 Hz Min/Max: 0.0/20.0 Hz Units: 0.1 Hz	055 082
		084 085 086	**[Skip Frequency 1]** **[Skip Frequency 2]** **[Skip Frequency 3]** Sets a frequency at which the drive will not operate. [Skip Frequency 1-3] and [Skip Frequency Band] must not equal 0.	Default: 0.0 Hz Default: 0.0 Hz Default: 0.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	087
		087	**[Skip Freq Band]** Determines the bandwidth around a skip frequency. [Skip Freq Band] is split, applying 1/2 above and 1/2 below the actual skip frequency. The same bandwidth applies to all skip frequencies.	Default: 0.0 Hz Min/Max: 0.0/30.0 Hz Units: 0.1 Hz	084 085 086

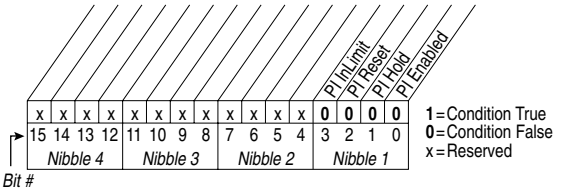


File C	Group	No.	Parameter Name and Description	Values	Related
SPEED COMMAND (File C)	Speed References	090	**[Speed Ref A Sel]** Selects the source of the speed reference to the drive unless [Speed Ref B Sel] or [Preset Speed 1-7] is selected. For more information on selecting a speed reference source, see Figure 1.9 on page 1-17. (1) See Appendix B for DPI port locations.	Default: 2 "Analog In 2" Options: 1 "Analog In 1" 2 "Analog In 2" 3-8 "Reserved" 9 "MOP Level" 10 "Reserved" 11 "Preset Spd1" 12 "Preset Spd2" 13 "Preset Spd3" 14 "Preset Spd4" 15 "Preset Spd5" 16 "Preset Spd6" 17 "Preset Spd7" 18 "DPI Port 1"(1) 19 "DPI Port 2"(1) 20 "DPI Port 3"(1) 21 "Reserved" 22 "DPI Port 5"(1) 23 "Reserved"	002 091 thru 093 101 thru 107 117 thru 120 192 thru 194 213 272 273 320 361 thru 366
		091	**[Speed Ref A Hi]** Scales the upper value of the [Speed Ref A Sel] selection when the source is an analog input.	Default: [Maximum Speed] Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	082
		092	**[Speed Ref A Lo]** Scales the lower value of the [Speed Ref A Sel] selection when the source is an analog input.	Default: 0.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	081
		093	**[Speed Ref B Sel]** See [Speed Ref A Sel].	Default: 11 "Preset Spd1" Options: See [Speed Ref A Sel]	See 090
		094	**[Speed Ref B Hi]** Scales the upper value of the [Speed Ref B Sel] selection when the source is an analog input.	Default: [Maximum Speed] Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	093
		095	**[Speed Ref B Lo]** Scales the lower value of the [Speed Ref B Sel] selection when the source is an analog input.	Default: 0.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	090 093
		096	**[TB Man Ref Sel]** Sets the manual speed reference source when a digital input is configured for "Auto/Manual." (1) "Analog In 2" is not a valid selection if it was selected for any of the following: - [Trim In Select] - [PI Feedback Sel] - [PI Reference Sel] - [Current Lmt Sel]	Default: 1 "Analog In 1" Options: 1 "Analog In 1" 2 "Analog In 2"(1) 3-8 "Reserved" 9 "MOP Level"	097 098

File C	Group	No.	Parameter Name and Description	Values	Related
SPEED COMMAND (File C)	Speed References	097	**[TB Man Ref Hi]** Scales the upper value of the [TB Man Ref Sel] selection when the source is an analog input.	Default: [Maximum Speed] Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	096
		098	**[TB Man Ref Lo]** Scales the lower value of the [TB Man Ref Sel] selection when the source is an analog input.	Default: 0.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	096
	Discrete Speeds	100	**[Jog Speed]** Sets the output frequency when a jog command is issued.	Default: 10.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	
		101 102 103 104 105 106 107	**[Preset Speed 1]** **[Preset Speed 2]** **[Preset Speed 3]** **[Preset Speed 4]** **[Preset Speed 5]** **[Preset Speed 6]** **[Preset Speed 7]** Provides an internal fixed speed command value. In bipolar mode direction is commanded by the sign of the reference.	Default: 5.0 Hz 10.0 Hz 20.0 Hz 30.0 Hz 40.0 Hz 50.0 Hz 60.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	090 093
	Speed Trim	117	**[Trim In Select]** Specifies which analog input signal is being used as a trim input.	Default: 2 "Analog In 2" Options: See [Speed Ref A Sel]	090 093
		118	**[Trim Out Select]** Specifies which speed references are to be trimmed.  *Factory Default Bit Values*	117 119 120
		119	**[Trim Hi]** Scales the upper value of the [Trim In Select] selection when the source is an analog input.	Default: 60.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	082 117
		120	**[Trim Lo]** Scales the lower value of the [Trim In Select] selection when the source is an analog input.	Default: 0.0 Hz Min/Max: –/+[Maximum Speed] Units: 0.1 Hz	117

File C	Group	No.	Parameter Name and Description	Values	Related
SPEED COMMAND (File C)	Slip Comp		**Important:** Parameters in the Slip Comp Group are used to enable and tune the Slip Compensation Regulator. In order to allow the Slip Compensation Regulator to control drive operation, parameter 080 [Speed Mode] must be set to 1 "Slip Comp".		
		121	**[Slip RPM @ FLA]** Sets the amount of compensation to drive output at motor FLA. If the value of parameter 061 [Autotune] = 3 "Calculate" changes made to this parameter will not be accepted.	Default: Based on [Motor NP RPM] Min/Max: 0.0/1200.0 RPM Units: 0.1 RPM	061 080 122 123
		122	**[Slip Comp Gain]** Sets the response time of slip compensation.	Default: 40.0 Min/Max: 1.0/100.0 Units: 0.1	080 121 122
		123	**[Slip RPM Meter]** Displays the present amount of adjustment being applied as slip compensation.	Default: Read Only Min/Max: 0.0/300.0 RPM Units: 0.1 RPM	080 121 122
	Process PI		**Important:** Parameters in the Process PI Group are used to enable and tune the PI Loop. In order to allow the PI Loop to control drive operation, parameter 080 [Speed Mode] must be set to 2 "Process PI".		
		124	**[PI Configuration]** Sets configuration of the PI regulator.  *Factory Default Bit Values*	124 thru 138
		125	**[PI Control]** Controls the PI regulator.  *Factory Default Bit Values*	080

File C	Group	No.	Parameter Name and Description	Values	Related
SPEED COMMAND (File C)	Process PI	126	**[PI Reference Sel]** Selects the source of the PI reference.	Default: 0 "PI Setpoint" Options: 0 "PI Setpoint" 1 "Analog In 1" 2 "Analog In 2" 3-8 "Reserved" 9 "MOP Level" 10 "Master Ref" 11-17 "Preset Spd1-7" 18-20 "DPI Port 1-3" 21 "Reserved" 22 "DPI Port 5" 23 "Reserved"	124 thru 138
		127	**[PI Setpoint]** Provides an internal fixed value for process setpoint when [PI Reference Sel] is set to "PI Setpoint."	Default: 50.00% Min/Max: –/+100.00% of Maximum Process Value Units: 0.01%	124 thru 138
		128	**[PI Feedback Sel]** Selects the source of the PI feedback.	Default: 2 "Analog In 2" Options: See [PI Reference Sel].	124 thru 138
		129	**[PI Integral Time]** Time required for the integral component to reach 100% of [PI Error Meter]. Not functional when the PI Hold bit of [PI Control] = "1" (enabled).	Default: 2.00 Secs Min/Max: 0.00/100.00 Secs Units: 0.01 Secs	124 thru 138
		130	**[PI Prop Gain]** Sets the value for the PI proportional component. PI Error × PI Prop Gain = PI Output	Default: 1.00 Min/Max: 0.00/100.00 Units: 0.01	124 thru 138
		131	**[PI Lower Limit]** Sets the lower limit of the PI output.	Default: –[Maximum Freq] Min/Max: –/+400.0 Hz Units: 0.1 Hz	124 thru 138
		132	**[PI Upper Limit]** Sets the upper limit of the PI output.	Default: +[Maximum Freq] Min/Max: –/+400.0 Hz Units: 0.1 Hz	124 thru 138
		133	**[PI Preload]** Sets the value used to preload the integral component on start or enable.	Default: 0.0 Hz Min/Max: –/+400.0 Hz Units: 0.1 Hz	124 thru 138

File C	Group	No.	Parameter Name and Description	Values	Related
SPEED COMMAND (File C)	Process PI	134	**[PI Status]** Status of the Process PI regulator.  	Read Only	124 thru 138
		135	**[PI Ref Meter]** Present value of the PI reference signal.	Default: Read Only Min/Max: –/+100.00% Units: 0.01%	124 thru 138
		136	**[PI Fdback Meter]** Present value of the PI feedback signal.	Default: Read Only Min/Max: –/+100.00% Units: 0.01%	124 thru 138
		137	**[PI Error Meter]** Present value of the PI error.	Default: Read Only Min/Max: –/+100.00% Units: 0.01%	124 thru 138
		138	**[PI Output Meter]** Present value of the PI output.	Default: Read Only Min/Max: –/+100.0 Hz Units: 0.1 Hz	124 thru 138

Dynamic Control File (File D)

File D	Group	No.	Parameter Name and Description	Values	Related
DYNAMIC CONTROL (File D)	Ramp Rates	140 141	**[Accel Time 1]** **[Accel Time 2]** Sets the rate of accel for all speed increases. $\frac{\text{Max Speed}}{\text{Accel Time}}$ = Accel Rate	Default: 10.0 Secs 10.0 Secs Min/Max: 0.1/3600.0 Secs Units: 0.1 Secs	142 143 146 361 thru 366
		142 143	**[Decel Time 1]** **[Decel Time 2]** Sets the rate of decel for all speed decreases. $\frac{\text{Max Speed}}{\text{Decel Time}}$ = Decel Rate	Default: 10.0 Secs 10.0 Secs Min/Max: 0.1/3600.0 Secs Units: 0.1 Secs	140 141 146 361 thru 366
		146	**[S Curve %]** Sets the percentage of accel or decel time that is applied to the ramp as S Curve. Time is added, 1/2 at the beginning and 1/2 at the end of the ramp.	Default: 0% Min/Max: 0/100% Units: 1%	140 thru 143

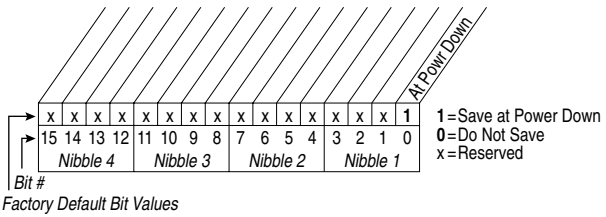
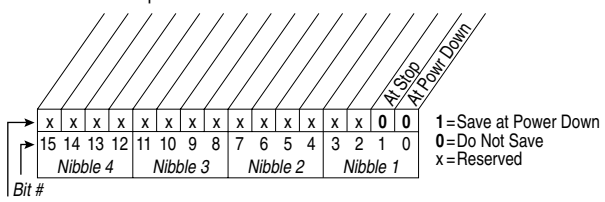
File D	Group	No.	Parameter Name and Description	Values	Related
DYNAMIC CONTROL (File D)	Load Limits	147	**[Current Lmt Sel]** Selects the source for the adjustment of current limit (i.e. parameter, analog input, etc.).	Default: 0 "Cur Lim Val" Options: 0 "Cur Lim Val" 1 "Analog In 1" 2 "Analog In 2"	146 149
		148	**[Current Lmt Val]** Defines the current limit value when [Current Lmt Sel] = "Cur Lim Val."	Default: [Rated Amps] × 1.5 (Equation yields approximate default value.) Min/Max: Based on Drive Rating Units: 0.1 Amps	147 149
		149	**[Current Lmt Gain]** Sets the responsiveness of the current limit.	Default: 250 Min/Max: 0/5000 Units: 1	147 148
		150	**[Drive OL Mode]** Selects the drive's response to increasing drive temperature.	Default: 3 "Both–PWM 1st" Options: 0 "Disabled" 1 "Reduce CLim" 2 "Reduce PWM" 3 "Both–PWM 1st"	219
		151	**[PWM Frequency]** Sets the carrier frequency for the PWM output. Drive derating may occur at higher carrier frequencies. For derating information, refer to the *PowerFlex Reference Manual*.	Default: 4 kHz Min/Max: 2/10 kHz Units: 1 kHz	
	Stop/Brake Modes	155 156	**[Stop Mode A]** **[Stop Mode B]** Active stop mode. [Stop Mode A] is active unless [Stop Mode B] is selected by inputs. (1) When using options 1 or 2, refer to the Attention statements at [DC Brake Level]. **ATTENTION:** If a hazard of injury do to movement of equipment or material exists, an auxiliary mechanical braking device must be used.	Default: 1 "Ramp" Default: 0 "Coast" Options: 0 "Coast" 1 "Ramp"(1) 2 "Ramp to Hold"(1) 3 "DC Brake"	157 158 159
		157	**[DC Brake Lvl Sel]** Selects the source for [DC Brake Level].	Default: 0 "DC Brake Lvl" Options: 0 "DC Brake Lvl" 1 "Analog In 1" 2 "Analog In 2"	155 156 158 159

File D	Group	No.	Parameter Name and Description	Values	Related
DYNAMIC CONTROL (File D)	Stop/Brake Modes	158	**[DC Brake Level]** Defines the DC brake current level injected into the motor when "DC Brake" is selected as a stop mode. The DC braking voltage used in this function is created by a PWM algorithm and may not generate the smooth holding force needed for some applications. Refer to the *PowerFlex Reference Manual*. **ATTENTION:** If a hazard of injury due to movement of equipment or material exists, an auxiliary mechanical braking device must be used. **ATTENTION:** This feature should not be used with synchronous or permanent magnet motors. Motors may be demagnetized during braking.	Default: [Rated Amps] Min/Max: 0/[Rated Amps] × 1.5 (Equation yields approximate maximum value.) Units: 0.1 Amps	
		159	**[DC Brake Time]** Sets the amount of time DC brake current is "injected" into the motor.	Default: 0.0 Secs Min/Max: 0.0/90.0 Secs Units: 0.1 Secs	155 thru 158
		160	**[Bus Reg Gain]** Sets the responsiveness of the bus regulator.	Default: 450 Min/Max: 0/5000 Units: 1	161 162
		161 162	**[Bus Reg Mode A]** **[Bus Reg Mode B]** Sets the method and sequence of the DC bus regulator voltage. Choices are dynamic brake, frequency adjust or both. Sequence is determined by programming or digital input to the terminal block. Dynamic Brake Setup If a dynamic brake resistor is connected to the drive, both these parameters must be set to either option 2, 3 or 4. Refer to the Attention statement on page P-4 for important information on bus regulation. **ATTENTION:** The drive does not offer protection for externally mounted brake resistors. A risk of fire exists if external braking resistors are not protected. External resistor packages must be self-protected from over temperature or the protective circuit shown in Figure C.1 on page C-1 (or equivalent) must be supplied.	Default: 1 "Adjust Freq" 4 "Both-Frq 1st" Options: 0 "Disabled" 1 "Adjust Freq" 2 "Dynamic Brak" 3 "Both-DB 1st" 4 "Both-Frq 1st"	160 163

File D	Group	No.	Parameter Name and Description	Values	Related
DYNAMIC CONTROL (File D)	Stop/Brake Modes	163	**[DB Resistor Type]** Selects whether the internal or an external DB resistor will be used. If a dynamic brake resistor is connected to the drive, [Bus Reg Mode A & B] must be set to either option 2, 3 or 4. **ATTENTION:** The drive does not offer protection for externally mounted brake resistors. A risk of fire exists if external braking resistors are not protected. External resistor packages must be self-protected from over temperature or the protective circuit shown in Figure C.1 on page C-1, or equivalent, must be supplied. **ATTENTION:** Equipment damage may result if a drive mounted (internal) resistor is installed and this parameter is set to "External Res." Thermal protection for the internal resistor will be disabled, resulting in possible device damage.	Default: 0 "Internal Res" Options: 0 "Internal Res" 1 "External Res" 2 "None"	161 162
	Restart Modes	168	**[Start At PowerUp]** Enables/disables a feature to issue a Start or Run command and automatically resume running at commanded speed after drive input power is restored. Requires a digital input configured for Run or Start and a valid start contact. **ATTENTION:** Equipment damage and/or personal injury may result if this parameter is used in an inappropriate application. Do not use this function without considering applicable local, national and international codes, standards, regulations or industry guidelines.	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Enabled"	
		169	**[Flying Start En]** Enables/disables the function which reconnects to a spinning motor at actual RPM when a start command is issued.	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Enabled"	170
		170	**[Flying StartGain]** Sets the response of the flying start function.	Default: 4000 Min/Max: 20/32767 Units: 1	169

File D	Group	No.	Parameter Name and Description	Values	Related
DYNAMIC CONTROL (File D)	Restart Modes	174	**[Auto Rstrt Tries]** Sets the maximum number of times the drive attempts to reset a fault and restart. **ATTENTION:** Equipment damage and/or personal injury may result if this parameter is used in an inappropriate application. Do not use this function without considering applicable local, national and international codes, standards, regulations or industry guidelines.	Default: 0 Min/Max: 0/9 Units: 1	175
		175	**[Auto Rstrt Delay]** Sets the time between restart attempts when [Auto Rstrt Tries] is set to a value other than zero.	Default: 1.0 Secs Min/Max: 0.5/30.0 Secs Units: 0.1 Secs	174
	Power Loss	184	**[Power Loss Mode]** Sets the reaction to a loss of input power. Power loss is recognized when: • DC bus voltage is ≤ 73% of [DC Bus Memory] and [Power Loss Mode] is set to “Coast”. • DC bus voltage is ≤ 82% of [DC Bus Memory] and [Power Loss Mode] is set to “Decel”.	Default: 0 “Coast” Options: 0 “Coast” 1 “Decel”	013 185
		185	**[Power Loss Time]** Sets the time that the drive will remain in power loss mode before a fault is issued.	Default: 0.5 Secs Min/Max: 0.0/60.0 Secs Units: 0.1 Secs	184

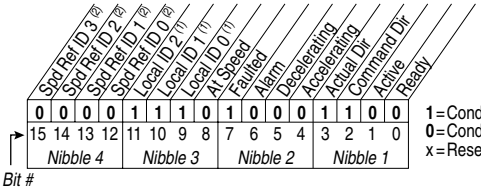
Utility File (File E)

File E	Group	No.	Parameter Name and Description	Values	Related
UTILITY (File E)	Direction Config	190	**[Direction Mode]** Selects the method for changing drive direction. **Mode** / **Direction Change** Unipolar / Drive Logic Bipolar / Sign of Reference Reverse Dis / Not Changable	Default: 0 "Unipolar" Options: 0 "Unipolar" 1 "Bipolar" 2 "Reverse Dis"	320 thru 327 361 thru 366
	HIM Ref Config	192	**[Save HIM Ref]** Enables a feature to save the present frequency reference value issued by the HIM to Drive memory on power loss. Value is restored to the HIM on power up.  *Factory Default Bit Values*		
		193	**[Man Ref Preload]** Enables/disables a feature to automatically load the present "Auto" frequency reference value into the HIM when "Manual" is selected. Allows smooth speed transition from "Auto" to "Manual."	Default: 0 "Disabled" Options: 0 "Disabled" 1 "Enabled"	
	MOP Config	194	**[Save MOP Ref]** Enables/disables the feature that saves the present MOP frequency reference at power down or at stop.  *Factory Default Bit Values*		
		195	**[MOP Rate]** Sets rate of change of the MOP reference in response to a digital input.	Default: 1.0 Hz/s Min/Max: 0.2/[Maximum Freq] Units: 0.1 Hz/s	

File E	Group	No.	Parameter Name and Description	Values			Related
UTILITY (File E)	Drive Memory	196	**[Param Access Lvl]** Selects the parameter display level. Basic = Reduced param. set Advanced = Full param. set	Default: Options:	0 0 1	"Basic" "Basic" "Advanced"	
		197	**[Reset To Defalts]** Resets all parameter values (except parameters 196, 201 & 202) to defaults. Option 1 resets drive to factory settings. Options 2 and 3 will reset drive to alternate voltage and current rating.	Default: Options:	0 0 1 2 3	"Ready" "Ready" "Factory" "Low Voltage" "High Voltage"	
		198	**[Load Frm Usr Set]** Loads a previously saved set of parameter values from a selected user set location in drive nonvolatile memory to active drive memory.	Default: Options:	0 0 1 2 3	"Ready" "Ready" "User Set 1" "User Set 2" "User Set 3"	199
		199	**[Save To User Set]** Saves the parameter values in active drive memory to a user set in drive nonvolatile memory.	Default: Options:	0 0 1 2 3	"Ready" "Ready" "User Set 1" "User Set 2" "User Set 3"	198
		200	**[Reset Meters]** Resets selected meters to zero.	Default: Options:	0 0 1 2	"Ready" "Ready" "MWh" "Elapsed Time"	
		201	**[Language]** Selects the display language when using an LCD HIM. This parameter is not functional with an LED HIM.	Default: Options:	0 0 1 2 3 4 5 6 7 8-9 10	"Not Selected" "Not Selected" "English" "Français" "Español" "Italiano" "Deutsch" "Reserved" "Português" "Reserved" "Nederlands"	
		202	**[Voltage Class]** Configures the drive current rating and associates it with the selected voltage (i.e. 400 or 480V). This parameter is normally used when downloading parameter sets.	Default: Options:	 2 3	Based on Drive Cat. No. "Low Voltage" "High Voltage"	
		203	**[Drive Checksum]** Provides a checksum value that indicates whether or not a change in drive programming has occurred.	Default: Min/Max: Units:	Read Only 0/65535 1		

File E	Group	No.	Parameter Name and Description	Values	Related
UTILITY (File E)	Diagnostics	209	**[Drive Status 1]**	Read Only	210

Present operating condition of the drive.

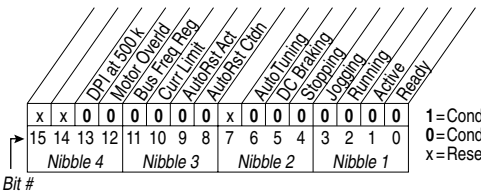


Bits (2)				
15	14	13	12	Description
0	0	0	0	Ref A Auto
0	0	0	1	Ref B Auto
0	0	1	0	Preset 2 Auto
0	0	1	1	Preset 3 Auto
0	1	0	0	Preset 4 Auto
0	1	0	1	Preset 5 Auto
0	1	1	0	Preset 6 Auto
0	1	1	1	Preset 7 Auto
1	0	0	0	TB Manual
1	0	0	1	Port 1 Manual
1	0	1	0	Port 2 Manual
1	0	1	1	Port 3 Manual
1	1	0	0	Port 4 Manual
1	1	0	1	Port 5 Manual
1	1	1	0	Port 6 Manual
1	1	1	1	Jog Ref

Bits (1)			
11	10	9	Description
0	0	0	Port 0 (TB)
0	0	1	Port 1
0	1	0	Port 2
0	1	1	Port 3
1	0	0	Port 4
1	0	1	Port 5
1	1	0	Port 6
1	1	1	No Local Control

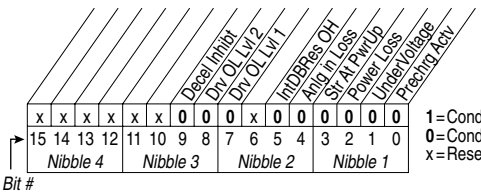
UTILITY (File E)	Diagnostics	210	**[Drive Status 2]**												Read Only		209

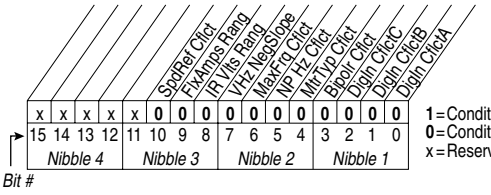
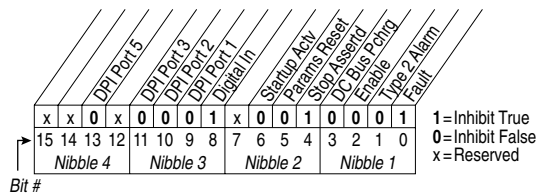
Present operating condition of the drive.

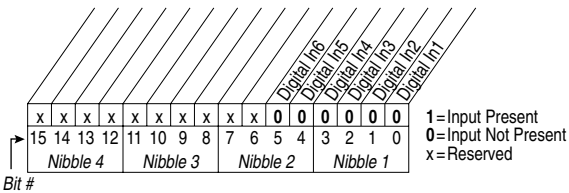
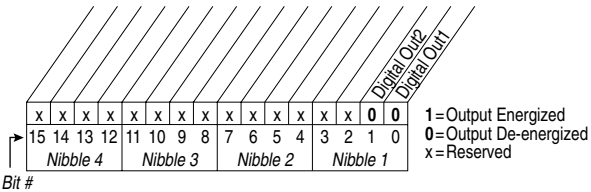


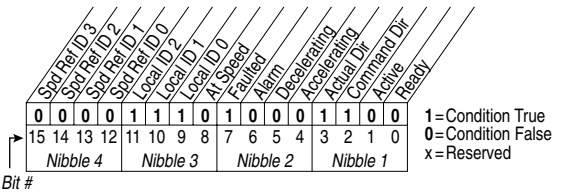
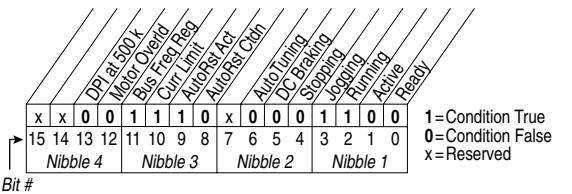
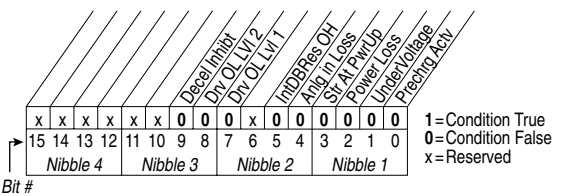
UTILITY (File E)	Diagnostics	211	**[Drive Alarm 1]**												Read Only		212

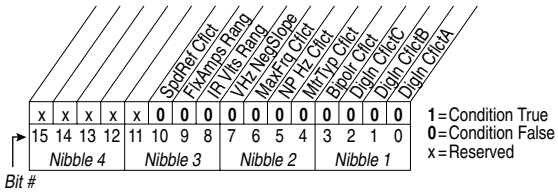
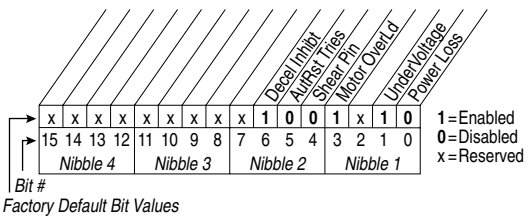
Alarm conditions that currently exist in the drive.

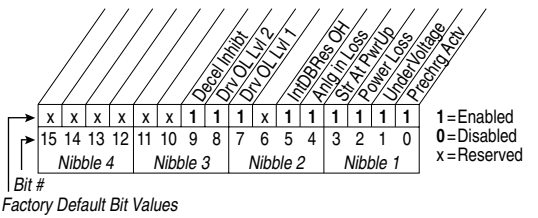

Decel Inhibit
Drv OL Lvl 2
Drv OL Lvl 1
IntDBRes OH
Anlg In Loss
Str At PwrUp
Power Loss
UnderVoltage
Prechg Actv
x x x x x x 0 0 0 x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Condition True
0 = Condition False
x = Reserved

File E	Group	No.	Parameter Name and Description	Values	Related
UTILITY (File E)	Diagnostics	212	**[Drive Alarm 2]** Alarm conditions that currently exist in the drive.  	Read Only	211
		213	**[Speed Ref Source]** Displays the source of the speed reference to the drive.	Default: Read Only Options: 0 "PI Output" 1 "Analog In 1" 2 "Analog In 2" 3-8 "Reserved" 9 "MOP Level" 10 "Jog Speed" 11 "Preset Spd1" 12 "Preset Spd2" 13 "Preset Spd3" 14 "Preset Spd4" 15 "Preset Spd5" 16 "Preset Spd6" 17 "Preset Spd7" 18 "DPI Port 1" 19 "DPI Port 2" 20 "DPI Port 3" 21 "Reserved" 22 "DPI Port 5" 23 "Reserved"	090 093 096 101
		214	**[Start Inhibits]** Displays the inputs currently preventing the drive from starting.  	Read Only	

File E	Group	No.	Parameter Name and Description	Values	Related
UTILITY (File E)	Diagnostics	215	**[Last Stop Source]** Displays the source that initiated the most recent stop sequence. It will be cleared (set to 0) during the next start sequence.	Default: Read Only Options: 0 "Pwr Removed" 1 "DPI Port 1" 2 "DPI Port 2" 3 "DPI Port 3" 4 "Reserved" 5 "DPI Port 5" 6 "Reserved" 7 "Digital In" 8 "Fault" 9 "Not Enabled" 10 "Sleep" 11 "Jog"	361 362 363 364 365 366
		216	**[Dig In Status]** Status of the digital inputs. 	Read Only	361 thru 366
		217	**[Dig Out Status]** Status of the digital outputs. 	Read Only	380 thru 384
		218	**[Drive Temp]** Present operating temperature of the drive power section.	Default: Read Only Min/Max: –/+100 degC Units: 1.0 degC	
		219	**[Drive OL Count]** Accumulated percentage of drive overload. Continuously operating the drive over 100% of its rating will increase this value to 100% and cause a drive fault or foldback depending on the setting of [Drive OL Mode].	Default: Read Only Min/Max: 0.0/100.0% Units: 0.1%	150
		220	**[Motor OL Count]** Accumulated percentage of motor overload. Continuously operating the motor over 100% of the motor overload setting will increase this value to 100% and cause a drive fault.	Default: Read Only Min/Max: 0.0/100.0% Units: 0.1%	047 048

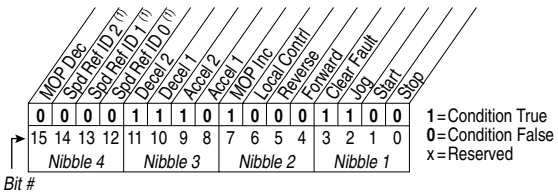
File E	Group	No.	Parameter Name and Description	Values	Related
UTILITY (File E)	Diagnostics	224	**[Fault Frequency]** Captures and displays the output speed of the drive at the time of the last fault.	Default: Read Only Min/Max: 0.0/+[Maximum Freq] Units: 0.1 Hz	225 thru 230
		225	**[Fault Amps]** Captures and displays motor amps at the time of the last fault.	Default: Read Only Min/Max: 0.0/[Rated Amps] × 2 Units: 0.1 Amps	224 thru 230
		226	**[Fault Bus Volts]** Captures and displays the DC bus voltage of the drive at the time of the last fault.	Default: Read Only Min/Max: 0.0/Max Bus Volts Units: 0.1 VDC	224 thru 230
		227	**[Status 1 @ Fault]** Captures and displays [Drive Status 1] bit pattern at the time of the last fault.  	Read Only	209 224 thru 230
		228	**[Status 2 @ Fault]** Captures and displays [Drive Status 2] bit pattern at the time of the last fault.  	Read Only	210 224 thru 230
		229	**[Alarm 1 @ Fault]** Captures and displays [Drive Alarm 1] at the time of the last fault.  	Read Only	211 224 thru 230

File E	Group	No.	Parameter Name and Description	Values	Related
UTILITY (File E)	Diagnostics	230	**[Alarm 2 @ Fault]** Captures and displays [Drive Alarm 2] at the time of the last fault.  	Read Only	212 224 thru 230
		234 236	**[Testpoint 1 Sel]** **[Testpoint 2 Sel]** Selects the function whose value is displayed value in [Testpoint x Data]. These are internal values that are not accessible through parameters. See Testpoint Codes and Functions on page 4-10 for a listing of available codes and functions.	Default: 499 Min/Max: 0/999 Units: 1	
		235 237	**[Testpoint 1 Data]** **[Testpoint 2 Data]** The present value of the function selected in [Testpoint x Sel].	Default: Read Only Min/Max: 0/65535 Units: 1	
	Faults	238	**[Fault Config 1]** Enables/disables annunciation of the listed faults.  *Factory Default Bit Values*		
		240	**[Fault Clear]** Resets a fault and clears the fault queue.	Default: 0 "Ready" Options: 0 "Ready" 1 "Clear Faults" 2 "Clr Flt Que"	
		241	**[Fault Clear Mode]** Enables/disables a fault reset (clear faults) attempt from any source. This does not apply to fault codes which are cleared indirectly via other actions.	Default: 1 "Enabled" Options: 0 "Disabled" 1 "Enabled"	
		242 32	**[Power Up Marker]** Elapsed hours since initial drive power up. This value will rollover to 0 after the drive has been powered on for more than the max value shown. For relevance to most recent power up see [Fault x Time].	Default: Read Only Min/Max: 0.0000/429,496.7295 Hr Units: 0.0001 Hr	244 246 248 250

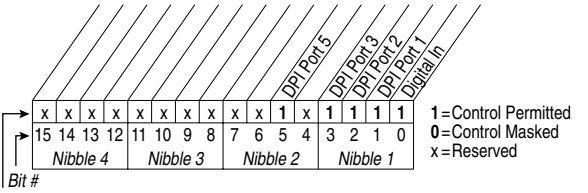
File E	Group	No.	Parameter Name and Description	Values	Related
UTILITY (File E)	Faults	243 245 247 249	**[Fault 1 Code]** **[Fault 2 Code]** **[Fault 3 Code]** **[Fault 4 Code]** A code that represents the fault that tripped the drive. The codes will appear in these parameters in the order they occur ([Fault 1 Code] = the most recent fault).	Default: Read Only Min/Max: 0/9999 Units: 0	
		244 246 248 250	**[Fault 1 Time]** **[Fault 2 Time]** **[Fault 3 Time]** **[Fault 4 Time]** 32 The time between **initial** drive power up and the occurrence of the associated trip fault. Can be compared to [Power Up Marker] for the time from the most recent power up. [Fault x Time] – [Power Up Marker] = Time difference to the most recent power up. A negative value indicates fault occurred before most recent power up. A positive value indicates fault occurred after most recent power up.	Default: Read Only Min/Max: 0.0000/429,496.7295 Hr Units: 0.0001 Hr	242
	Alarms	259	**[Alarm Config 1]** Enables/disables alarm conditions that will initiate an active drive alarm.  *Factory Default Bit Values*		

Communication File (File H)

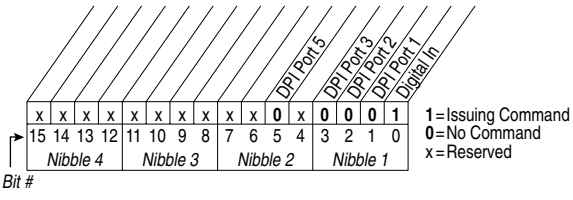
File H	Group	No.	Parameter Name and Description	Values	Related
COMMUNICATION (File H)	Comm Control	270	**[DPI Data Rate]** Sets the baud rate for attached drive peripherals. When changing this value the drive must be reset for the change to take affect.	Default: 0 "125 kbps" Options: 0 "125 kbps" 1 "500 kbps"	
		271	**[Drive Logic Rslt]** The final logic command resulting from the combination of all DPI and discrete inputs. This parameter has the same structure as the product-specific logic command received via DPI and is used in peer to peer communications.	Read Only	
		272	**[Drive Ref Rslt]** Present frequency reference scaled as a DPI reference for peer to peer communications. The value shown is the value prior to the accel/decel ramp and any corrections supplied by slip comp, PI, etc.	Default: Read Only Min/Max: –/+32767 Units: 1	
		273	**[Drive Ramp Rslt]** Present frequency reference scaled as a DPI reference for peer to peer communications. The value shown is the value after the accel/decel ramp but prior to any corrections supplied by slip comp, PI, etc.	Default: Read Only Min/Max: –/+32767 Units: 1	



Bits(1)			
14	13	12	Description
0	0	0	No Command - Man. Mode
0	0	1	Ref A Auto
0	1	0	Ref B Auto
0	1	1	Preset 3 Auto
1	0	0	Preset 4 Auto
1	0	1	Preset 5 Auto
1	1	0	Preset 6 Auto
1	1	1	Preset 7 Auto

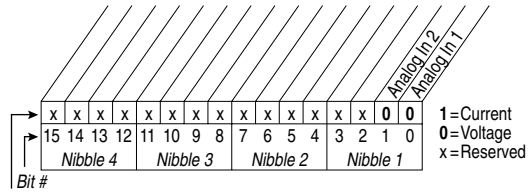
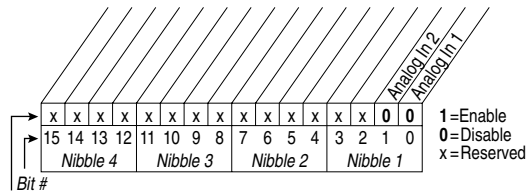
File H	Group	No.	Parameter Name and Description	Values	Related
COMMUNICATION (File H)	Masks & Owners	276	**[Logic Mask]** Determines which adapters can control the drive. If the bit for an adapter is set to "0," the adapter will have no control functions except for stop.  		288 thru 297
		277	**[Start Mask]** Controls which adapters can issue start commands.	See [Logic Mask].	288 thru 297
		278	**[Jog Mask]** Controls which adapters can issue jog commands.	See [Logic Mask].	288 thru 297
		279	**[Direction Mask]** Controls which adapters can issue forward/reverse direction commands.	See [Logic Mask].	288 thru 297
		280	**[Reference Mask]** Controls which adapters can select an alternate reference; [Speed Ref A, B Sel] or [Preset Speed 1-7].	See [Logic Mask].	288 thru 297
		281	**[Accel Mask]** Controls which adapters can select [Accel Time 1, 2].	See [Logic Mask].	288 thru 297
		282	**[Decel Mask]** Controls which adapters can select [Decel Time 1, 2].	See [Logic Mask].	288 thru 297
		283	**[Fault Clr Mask]** Controls which adapters can clear a fault.	See [Logic Mask].	288 thru 297
		284	**[MOP Mask]** Controls which adapters can issue MOP commands to the drive.	See [Logic Mask].	288 thru 297
		285	**[Local Mask]** Controls which adapters are allowed to take exclusive control of drive logic commands (except stop). Exclusive "local" control can only be taken while the drive is stopped.	See [Logic Mask].	288 thru 297

File H	Group	No.	Parameter Name and Description	Values	Related
COMMUNICATION (File H)	Masks & Owners	288	**[Stop Owner]** Adapters that are presently issuing a valid stop command.	Read Only	276 thru 285
		289	**[Start Owner]** Adapters that are presently issuing a valid start command.	See [Stop Owner].	276 thru 285
		290	**[Jog Owner]** Adapters that are presently issuing a valid jog command.	See [Stop Owner].	276 thru 285
		291	**[Direction Owner]** Adapter that currently has exclusive control of direction changes.	See [Stop Owner].	276 thru 285
		292	**[Reference Owner]** Adapter that has the exclusive control of the command frequency source selection.	See [Stop Owner].	276 thru 285
		293	**[Accel Owner]** Adapter that has exclusive control of selecting [Accel Time 1, 2].	See [Stop Owner].	140 276 thru 285
		294	**[Decel Owner]** Adapter that has exclusive control of selecting [Decel Time 1, 2].	See [Stop Owner].	142 276 thru 285
		295	**[Fault Clr Owner]** Adapter that is presently clearing a fault.	See [Stop Owner].	276 thru 285
		296	**[MOP Owner]** Adapters that are currently issuing increases or decreases in MOP command frequency.	See [Stop Owner].	276 thru 285
		297	**[Local Owner]** Adapter that has requested exclusive control of all drive logic functions. If an adapter is in local lockout, all other functions (except stop) on all other adapters are locked out and non-functional. Local control can only be obtained when the drive is not running.	See [Stop Owner].	276 thru 285


DPI Port 5
DPI Port 3
DPI Port 2
DPI Port 1
Digital In
x x x x x x x x x x 0 x 0 0 0 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Issuing Command
0 = No Command
x = Reserved

File H	Group	No.	Parameter Name and Description	Values	Related
COMMUNICATION (File H)	Datalinks	300 301	**[Data In A1] -** Link A Word 1 **[Data In A2] -** Link A Word 2 Parameter number whose value will be written from a communications device data table. Parameters that can only be changed while drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type will "Disable" the link. Refer to your communications option manual for datalink information.	Default: 0 (0 = "Disabled") Min/Max: 0/387 Units: 1	
		302 303	**[Data In B1] -** Link B Word 1 **[Data In B2] -** Link B Word 2	See [Data In A1] - Link A Word 1.	
		304 305	**[Data In C1] -** Link C Word 1 **[Data In C2] -** Link C Word 2	See [Data In A1] - Link A Word 1.	
		306 307	**[Data In D1] -** Link D Word 1 **[Data In D2] -** Link D Word 2	See [Data In A1] - Link A Word 1.	
		310 311	**[Data Out A1] -** Link A Word 1 **[Data Out A2] -** Link A Word 2 Parameter number whose value will be written to a communications device data table.	Default: 0 (0 = "Disabled") Min/Max: 0/387 Units: 1	
		312 313	**[Data Out B1] -** Link B Word 1 **[Data Out B2] -** Link B Word 2	See [Data Out A1] - Link A Word 1.	
		314 315	**[Data Out C1] -** Link C Word 1 **[Data Out C2] -** Link C Word 2	See [Data Out A1] - Link A Word 1.	
		316 317	**[Data Out D1] -** Link D Word 1 **[Data Out D2] -** Link D Word 2	See [Data Out A1] - Link A Word 1.	

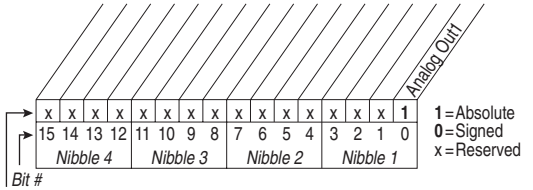
Inputs & Outputs File (File J)

File J	Group	No.	Parameter Name and Description	Values	Related
INPUTS & OUTPUTS (File J)	Analog Inputs	320	**[Anlg In Config]** Selects the mode for the analog inputs.  *Factory Default Bit Values*		322 325 323 326
		321	**[Anlg In Sqr Root]** Enables/disables the square root function for each input.  *Factory Default Bit Values*		
		322 325	**[Analog In 1 Hi]** **[Analog In 2 Hi]** Sets the highest input value to the analog input x scaling block.	Default: 10.000 Volt 10.000 Volt Min/Max: 4.000/20.000mA, –/+10.000V, 0.000/10.000V Units: 0.001 mA, 0.001 Volt	091 092
		323 326	**[Analog In 1 Lo]** **[Analog In 2 Lo]** Sets the lowest input value to the analog input x scaling block.	Default: 0.000 Volt 0.000 Volt Min/Max: 4.000/20.000mA, 0.000/10.000V (No. 323), –/+10.000V (No. 326) Units: 0.000/10.000V, 0.001 mA, 0.001 Volt	091 092
		324 327	**[Analog In 1 Loss]** **[Analog In 2 Loss]** Selects drive action when an analog signal loss is detected. Signal loss is defined as an analog signal less than 1V or 2mA. The signal loss event ends and normal operation resumes when the input signal level is greater than or equal to 1.5V or 3mA.	Default: 0 "Disabled" 0 "Disabled" Options: 0 "Disabled" 1 "Fault" 2 "Hold Input" 3 "Set Input Lo" 4 "Set Input Hi" 5 "Goto Preset1" 6 "Hold OutFreq"	091 092

INPUTS & OUTPUTS (File J) — **Analog Outputs**

341 [Anlg Out Absolut] — Related: 342

Selects whether the signed value or absolute value of a parameter is used before being scaled to drive the analog output.


Analog Out1
x x x x x x x x x x x x x x x 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Absolute
0 = Signed
x = Reserved

Factory Default Bit Values

342 [Analog Out1 Sel] — Related: 001, 002, 003, 004, 005, 007, 006, 012, 135, 136, 137, 138, 220, 219

Selects the source of the value that drives the analog output.

Default: 0 "Output Freq"

Options: See Table

Options	[Analog Out1 Lo] Value *Param. 341= Signed*	[Analog Out1 Lo] Value *Param. 341 = Absolute*	[Analog Out1 Hi] Value
0 "Output Freq"	–[Maximum Speed]	0 Hz	+[Maximum Speed]
1 "Command Freq"	–[Maximum Speed]	0 Hz	+[Maximum Speed]
2 "Output Amps"	0 Amps	0 Amps	200% Rated
3 "Torque Amps"	–200% Rated	0 Amps	200% Rated
4 "Flux Amps"	0 Amps	0 Amps	200% Rated
5 "Output Power"	0 kW	0 kW	200% Rated
6 "Output Volts"	0 Volts	0 Volts	120% Rated Input Volts
7 "DC Bus Volts"	0 Volts	0 Volts	200% Rated Input Volts
8 "PI Reference"	–100%	0%	100%
9 "PI Feedback"	–100%	0%	100%
10 "PI Error"	–100%	0%	100%
11 "PI Output"	–100%	0%	100%
12 "%Motor OL"	0%	0%	100%
13 "%Drive OL"	0%	0%	100%

343 [Analog Out1 Hi] — Related: 342

Sets the analog output value when the source value is at maximum.

Default: 10.00 Volts

Min/Max: 0.00/10.00 Volts

Units: 0.01 Volt

344 [Analog Out1 Lo] — Related: 342

Sets the analog output value when the source value is at minimum.

Default: 0.00 Volts

Min/Max: 0.00/10.00 Volts

Units: 0.01 Volt

File J	Group	No.	Parameter Name and Description	Values			Related
INPUTS & OUTPUTS (File J)	Digital Inputs	361	**[Digital In1 Sel]**	Default:	4	"Stop – CF" (CF = Clear Fault)	
		362	**[Digital In2 Sel]**	Default:	5	"Start"	
		363	**[Digital In3 Sel]**	Default:	18	"Auto/ Manual"	
		364	**[Digital In4 Sel]**	Default:	15	"Speed Sel 1"	
		365	**[Digital In5 Sel]**	Default:	16	"Speed Sel 2"	
		366	**[Digital In6 Sel]**	Default:	17	"Speed Sel 3"	
			Selects the function for the digital inputs. (1) When [Digital Inx Sel] is set to option 2 "Clear Faults" the Stop button cannot be used to clear a fault condition. (2) Typical 3-Wire Inputs. Requires that only 3-wire functions are chosen. Including 2-wire selections will cause a type 2 alarm. (3) Typical 2-Wire Inputs. Requires that only 2-wire functions are chosen. Including 3-wire selections will cause a type 2 alarm. (4) Speed Select Inputs. To access Preset Speed 1, set [Speed Ref A Sel] or [Speed Ref B Sel] to "Preset Speed 1". Type 2 Alarms Some digital input programming may cause conflicts that will result in a Type 2 alarm. Example: [Digital In1 Sel] set to 5 "Start" in 3-wire control and [Digital In2 Sel] set to 7 "Run" in 2-wire. Refer to Alarm Descriptions on page 4-7 for information on resolving this type of conflict. (5) Auto/Manual - Refer to Figure 1.9 on page 1-17 for details. (6) Opening an "Enable" input will cause the motor to coast-to-stop, ignoring any programmed Stop modes. (7) A "Dig In ConflictB" alarm will occur if a "Start" input is programmed without a "Stop" input.	Options:	0	"Not Used"	
					1	"Enable"(6)	
					2	"Clear Faults"(1)	
					3	"Aux Fault"	
					4	"Stop – CF"	
					5	"Start"(2)(7)	
					6	"Fwd/ Reverse"(2)	
					7	"Run"(3)	
					8	"Run Forward"(3)	
					9	"Run Reverse"(3)	
					10	"Jog"(2)	100
					11	"Jog Forward"	
					12	"Jog Reverse"	
					13	"Stop Mode B"	156
					14	"Bus Reg Md B"	162
					15	"Speed Sel 1"(4)	
					16	"Speed Sel 2"(4)	
					17	"Speed Sel 3"(4)	
					18	"Auto/ Manual"(5)	096
					19	"Local"	
					20	"Acc2 & Dec2"	140
					21	"Accel 2"	
					22	"Decel 2"	
					23	"MOP Inc"	194
					24	"MOP Dec"	
					25	"Excl Link"	380
					26	"PI Enable"	124
					27	"PI Hold"	
					28	"PI Reset"	

3	2	1	Auto Reference Source
0	0	0	Reference A
0	0	1	Reference B
0	1	0	Preset Speed 2
0	1	1	Preset Speed 3
1	0	0	Preset Speed 4
1	0	1	Preset Speed 5
1	1	0	Preset Speed 6
1	1	1	Preset Speed 7

File J	Group	No.	Parameter Name and Description	Values		Related
INPUTS & OUTPUTS (File J)	Digital Outputs	380 384	**[Digital Out1 Sel]** **[Digital Out2 Sel]** Selects the drive status that will energize a (CRx) output relay. (1) Any relay programmed as Fault or Alarm will energize (pick up) when power is applied to drive and deenergize (drop out) when a fault or alarm exists. Relays selected for other functions will energize only when that condition exists and will deenergize when condition is removed. refer to page 1-14. (2) Activation level is defined in [Dig Outx Level] below.	Default: Options:	1 "Fault" 4 "Run" 1 "Fault"(1) 2 "Alarm"(1) 3 "Ready" 4 "Run" 5 "Forward Run" 6 "Reverse Run" 7 "Auto Restart" 8 "Powerup Run" 9 "At Speed" 10 "At Freq"(2) 11 "At Current"(2) 12 "At Torque"(2) 13 "At Temp"(2) 14 "At Bus Volts"(2) 15 "At PI Error"(2) 16 "DC Braking" 17 "Curr Limit" 18 "Economize" 19 "Motor Overld" 20 "Power Loss" 21 "Input 1 Link" 22 "Input 2 Link" 23 "Input 3 Link" 24 "Input 4 Link" 25 "Input 5 Link" 26 "Input 6 Link"	381 385 382 386 383 002 001 003 004 218 012 137 157 147 053 048 184
		381 385	**[Dig Out1 Level]** **[Dig Out2 Level]** Sets the relay activation level for options 10 – 15 in [Digital Outx Sel]. Units are assumed to match the above selection (i.e. "At Freq" = Hz, "At Torque" = Amps).	Default: Min/Max: Units:	0.0 0.0 0.0/819.2 0.1	380
		382 386	**[Dig Out1 OnTime]** **[Dig Out2 OnTime]** Sets the "ON Delay" time for the digital outputs. This is the time between the occurrence of a condition and activation of the relay.	Default: Min/Max: Units:	0.00 Secs 0.00 Secs 0.00/600.00 Secs 0.01 Secs	380
		383 387	**[Dig Out1 OffTime]** **[Dig Out2 OffTime]** Sets the "OFF Delay" time for the digital outputs. This is the time between the disappearance of a condition and de-activation of the relay.	Default: Min/Max: Units:	0.00 Secs 0.00 Secs 0.00/600.00 Secs 0.01 Secs	380

Parameter Cross Reference – by Name

Parameter Name	No.	Group
Accel Mask	281	Masks & Owners
Accel Owner	293	Masks & Owners
Accel Time x	140, 141	Ramp Rates
Alarm 1 @ Fault	229	Diagnostics
Alarm 2 @ Fault	230	Diagnostics
Alarm Config 1	259	Alarms
Analog In x Hi	322, 325	Analog Inputs
Analog In x Lo	323, 326	Analog Inputs
Analog In x Loss	324, 327	Analog Inputs
Analog Inx Value	016, 017	Metering
Anlg Out Absolut	341	Analog Outputs
Analog Out1 Hi	343	Analog Outputs
Analog Out1 Lo	344	Analog Outputs
Analog Out1 Sel	342	Analog Outputs
Anlg In Config	320	Analog Inputs
Anlg In Sqr Root	321	Analog Inputs
Auto Rstrt Delay	175	Restart Modes
Auto Rstrt Tries	174	Restart Modes
Autotune	061	Torq Attributes
Break Frequency	072	Volts per Hertz
Break Voltage	071	Volts per Hertz
Bus Reg Gain	160	Stop/Brake Modes
Bus Reg Mode x	161, 162	Stop/Brake Modes
Commanded Freq	002	Metering
Compensation	056	Torq Attributes
Control SW Ver	029	Drive Data
Current Lmt Gain	149	Load Limits
Current Lmt Sel	147	Load Limits
Current Lmt Val	148	Load Limits
Data In A1	300	Data Links
Data In A2	301	Data Links
Data In B1	302	Data Links
Data In B2	303	Data Links
Data In C1	304	Data Links
Data In C2	305	Data Links
Data In D1	306	Data Links
Data In D2	307	Data Links
Data Out A1	310	Data Links
Data Out A2	311	Data Links
Data Out B1	312	Data Links
Data Out B2	313	Data Links
Data Out C1	314	Data Links
Data Out C2	315	Data Links
Data Out D1	316	Data Links
Data Out D2	317	Data Links
DB Resistor Type	163	Stop/Brake Modes
DC Brake Level	158	Stop/Brake Modes
DC Brake Time	159	Stop/Brake Modes
DC Brake Lvl Sel	157	Stop/Brake Modes
DC Bus Memory	013	Metering
DC Bus Voltage	012	Metering
Decel Mask	282	Masks & Owners
Decel Owner	294	Masks & Owners
Decel Time x	142, 143	Ramp Rates
Dig In Status	216	Diagnostics
Dig Out Status	217	Diagnostics
Dig Outx Level	381, 385	Digital Outputs
Dig Outx OffTime	383, 387	Digital Outputs
Dig Outx OnTime	382, 386	Digital Outputs
Digital Inx Sel	361-366	Digital Inputs
Digital Outx Sel	380, 384	Digital Outputs
Direction Mask	279	Masks & Owners
Direction Mode	190	Reverse Config
Direction Owner	291	Masks & Owners
DPI Data Rate	270	Comm Control
Drive Alarm x	211, 212	Diagnostics
Drive Checksum	203	Drive Memory
Drive Logic Rslt	271	Comm Control
Drive OL Count	219	Diagnostics
Drive OL Mode	150	Load Limits
Drive Ramp Rslt	273	Comm Control
Drive Ref Rslt	272	Comm Control
Drive Status x	209, 210	Diagnostics
Drive Temp	218	Diagnostics
Elapsed MWh	009	Metering
Elapsed Run Time	010	Metering
Fault Amps	225	Diagnostics
Fault Bus Volts	226	Diagnostics
Fault Clear	240	Faults
Fault Clear Mode	241	Faults
Fault Clr Mask	283	Masks & Owners
Fault Clr Owner	295	Masks & Owners
Fault Config 1	238	Faults
Fault Frequency	224	Diagnostics
Fault x Code	243-249	Faults
Fault x Time	244-250	Faults
Flux Current	005	Metering
Flux Current Ref	063	Torq Attributes
Flux Up Mode	057	Torq Attributes
Flux Up Time	058	Torq Attributes
Flying Start En	169	Restart Modes
Flying StartGain	170	Restart Modes
IR Voltage Drop	062	Torq Attributes
Jog Mask	278	Masks & Owners
Jog Owner	290	Masks & Owners
Jog Speed	100	Discrete Speeds
Language	201	Drive Memory
Last Stop Source	215	Diagnostics
Load Frm Usr Set	198	Drive Memory
Local Mask	285	Masks & Owners
Local Owner	297	Masks & Owners
Logic Mask	276	Masks & Owners

Parameter Name	No.	Group
Man Ref Preload	193	HIM Ref Config
Maximum Freq	055	Torq Attributes
Maximum Speed	082	Spd Mode & Limits
Maximum Voltage	054	Torq Attributes
Minimum Speed	081	Spd Mode & Limits
MOP Frequency	011	Metering
MOP Mask	284	Masks & Owners
MOP Owner	296	Masks & Owners
MOP Rate	195	MOP Config
Motor NP FLA	042	Motor Data
Motor NP Hertz	043	Motor Data
Motor NP Power	045	Motor Data
Motor NP RPM	044	Motor Data
Motor NP Volts	041	Motor Data
Motor OL Count	220	Diagnostics
Motor OL Factor	048	Motor Data
Motor OL Hertz	047	Motor Data
Motor Type	040	Motor Data
Mtr NP Pwr Units	046	Motor Data
Output Current	003	Metering
Output Freq	001	Metering
Output Power	007	Metering
Output Powr Fctr	008	Metering
Output Voltage	006	Metering
Overspeed Limit	083	Spd Mode & Limits
Param Access Lvl	196	Drive Memory
PI Configuration	124	Process PI
PI Control	125	Process PI
PI Error Meter	137	Process PI
PI Fdback Meter	136	Process PI
PI Feedback Sel	128	Process PI
PI Integral Time	129	Process PI
PI Lower Limit	131	Process PI
PI Output Meter	138	Process PI
PI Preload	133	Process PI
PI Prop Gain	130	Process PI
PI Ref Meter	135	Process PI
PI Reference Sel	126	Process PI
PI Setpoint	127	Process PI
PI Status	134	Process PI
PI Upper Limit	132	Process PI
Power Loss Mode	184	Power Loss
Power Loss Time	185	Power Loss
Power Up Marker	242	Faults
Preset Speed x	101-107	Discrete Speeds
PWM Frequency	151	Load Limits
Rated Amps	028	Drive Data
Rated kW	026	Drive Data
Rated Volts	027	Drive Data
Reference Mask	280	Masks & Owners
Reference Owner	292	Masks & Owners
Reset Meters	200	Drive Memory
Reset To Defalts	197	Drive Memory
Run Boost	070	Volts per Hertz
S Curve %	146	Ramp Rates
Save HIM Ref	192	HIM Ref Config
Save MOP Ref	194	MOP Config
Save To User Set	199	Drive Memory
Skip Freq Band	087	Spd Mode & Limits
Skip Frequency x	084-086	Spd Mode & Limits
Slip Comp Gain	122	Slip Comp
Slip RPM @ FLA	121	Slip Comp
Slip RPM Meter	123	Slip Comp
Speed Mode	080	Spd Mode & Limits
Speed Ref A Hi	091	Speed References
Speed Ref A Lo	092	Speed References
Speed Ref A Sel	090	Speed References
Speed Ref B Hi	094	Speed References
Speed Ref B Lo	095	Speed References
Speed Ref B Sel	093	Speed References
Speed Ref Source	213	Diagnostics
Start At PowerUp	168	Restart Modes
Start Inhibits	214	Diagnostics
Start Mask	277	Masks & Owners
Start Owner	289	Masks & Owners
Start/Acc Boost	069	Volts per Hertz
Status 1@ Fault	227	Diagnostics
Status 2 @ Fault	228	Diagnostics
Stop Mode x	155, 156	Stop/Brake Modes
Stop Owner	288	Masks & Owners
TB Man Ref Hi	097	Speed References
TB Man Ref Lo	098	Speed References
TB Man Ref Sel	096	Speed References
Testpoint x Data	235, 237	Diagnostics
Testpoint x Sel	234, 236	Diagnostics
Torque Current	004	Metering
Torque Perf Mode	053	Torq Attributes
Trim Hi	119	Speed Trim
Trim In Select	117	Speed Trim
Trim Lo	120	Speed Trim
Trim Out Select	118	Speed Trim
Voltage Class	202	Drive Memory

Troubleshooting

Chapter 4 provides information to guide you in troubleshooting the PowerFlex 70. Included is a listing and description of drive faults (with possible solutions, when applicable) and alarms.

For information on...	See page...
Faults and Alarms	4-1
Drive Status	4-2
Manually Clearing Faults	4-3
Fault Descriptions	4-3
Clearing Alarms	4-7
Alarm Descriptions	4-7
Testpoint Codes and Functions	4-10
Common Symptoms and Corrective Actions	4-10

Faults and Alarms

A fault is a condition that stops the drive. There are three fault types.

Type	Fault Description	
①	Auto-Reset Run	When this type of fault occurs, and [Auto Rstrt Tries] (see page 3-22) is set to a value greater than "0," a user-configurable timer, [Auto Rstrt Delay] (see page 3-22) begins. When the timer reaches zero, the drive attempts to automatically reset the fault. If the condition that caused the fault is no longer present, the fault will be reset and the drive will be restarted.
②	Non-Resettable	This type of fault normally requires drive or motor repair. The cause of the fault must be corrected before the fault can be cleared. The fault will be reset on power up after repair.
③	User Configurable	These faults can be enabled/disabled to annunciate or ignore a fault condition.

An alarm is a condition that, if left untreated, may stop the drive. There are two alarm types.

Type	Alarm Description	
①	User Configurable	These alarms can be enabled or disabled through [Alarm Config 1] on page 3-30.
②	Non-Configurable	These alarms are always enabled.

Drive Status

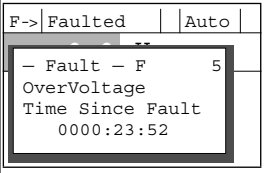
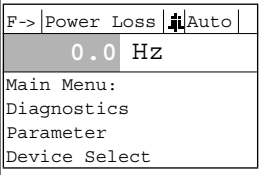
The condition or state of your drive is constantly monitored. Any changes will be indicated through the LEDs and/or the HIM (if present).

LED Indications

See page 2-2 for information on LED status indicators.

HIM Indication

The LCD and LED HIMs also provide visual notification of a fault or alarm condition.

Condition	Display
Drive is indicating a fault. The LCD HIM immediately reports the fault condition by displaying the following. • "Faulted" appears in the status line • Fault number • Fault name • Time that has passed since fault occurred Press Esc to regain HIM control. The LED HIM reports the fault condition by displaying the specific fault code.	LCD HIM  LED HIM
Drive is indicating an alarm. The LCD HIM immediately reports the alarm condition by displaying the following. • Alarm name (Type 2 alarms only) • Alarm bell graphic	LCD HIM  LED HIM No indication.

Manually Clearing Faults

Step	Key(s)
1. Press Esc to acknowledge the fault. The fault information will be removed so that you can use the HIM.	Esc
2. Address the condition that caused the fault. The cause must be corrected before the fault can be cleared.	
3. After corrective action has been taken, clear the fault by one of these methods. • Press Stop • Cycle drive power • Set parameter 240 [Fault Clear] to "1." • "Clear Faults" on the HIM Diagnostic menu.	

Fault Descriptions

Table 4.A Fault Types, Descriptions and Actions

Fault	No.	Type(1)	Description	Action
Analog In Loss	29	① ③	An analog input is configured to fault on signal loss. A signal loss has occurred. Configure with [Anlg In 1, 2 Loss] on page 3-35.	1. Check parameters. 2. Check for broken/loose connections at inputs.
Anlg Cal Chksum	108		The checksum read from the analog calibration data does not match the checksum calculated.	Replace drive.
Auto Rstrt Tries	33	③	Drive unsuccessfully attempted to reset a fault and resume running for the programmed number of [Flt RstRun Tries]. Enable/Disable with [Fault Config 1] on page 3-29.	Correct the cause of the fault and manually clear.
AutoTune Aborted	80		Autotune function was canceled by the user or a fault occurred.	Restart procedure.
Auxiliary Input	2	①	Auxiliary input interlock is open.	Check remote wiring.
Decel Inhibit	24	③	The drive is not following a commanded deceleration because it is attempting to limit bus voltage.	1. Verify input voltage is within drive specified limits. 2. Verify system ground impedance follows proper grounding techniques. 3. Disable bus regulation and/or add dynamic brake resistor and/or extend deceleration time.

Fault	No.	Type(1)	Description	Action
Drive OverLoad	64		Drive rating of 110% for 1 minute or 150% for 3 seconds has been exceeded.	Reduce load or extend Accel Time.
Excessive Load	79		Motor did not come up to speed in the allotted time during autotune.	1. Uncouple load from motor. 2. Repeat Autotune.
FluxAmpsRef Rang	78		The value for flux amps determined by the Autotune procedure exceeds the programmed [Motor NP FLA].	1. Reprogram [Motor NP FLA] with the correct motor nameplate value. 2. Repeat Autotune.
Ground Fault	13	①	A current path to earth ground greater than 25% of drive rating.	Check the motor and external wiring to the drive output terminals for a grounded condition.
Heatsink OvrTemp	8	①	Heatsink temperature exceeds 100% of [Drive Temp].	1. Verify that maximum ambient temperature has not been exceeded. 2. Check fan. 3. Check for excess load.
HW OverCurrent	12	①	The drive output current has exceeded the hardware current limit.	Check programming. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current.
Incompat MCB-PB	106	②	Drive rating information stored on the power board is incompatible with the main control board.	Load compatible version files into drive.
IR Volts Range	77		"Calculate" is the autotune default and the value determined by the autotune procedure for IR Drop Volts is not in the range of acceptable values.	Re-enter motor nameplate data.
Motor Overload	7	① ③	Internal electronic overload trip. Enable/Disable with [Fault Config 1] on page 3-29.	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by [Motor NP FLA].
OverSpeed Limit	25	①	Functions such as Slip Compensation or Bus Regulation have attempted to add an output frequency adjustment greater than that programmed in [Overspeed Limit].	Remove excessive load or overhauling conditions or increase [Overspeed Limit].
OverVoltage	5	①	DC bus voltage exceeded maximum value.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.
Parameter Chksum	100	②	The checksum read from the board does not match the checksum calculated.	1. Restore defaults. 2. Reload User Set if used.

Fault	No.	Type(1)	Description	Action
Params Defaulted	48		The drive was commanded to write default values to EEPROM.	1. Clear the fault or cycle power to the drive. 2. Program the drive parameters as needed.
Phase U to Grnd	38		A phase to ground fault has been detected between the drive and motor in this phase.	1. Check the wiring between the drive and motor. 2. Check motor for grounded phase. 3. Replace drive.
Phase V to Grnd	39			
Phase W to Grnd	40			
Phase UV Short	41		Excessive current has been detected between these two output terminals.	1. Check the motor and drive output terminal wiring for a shorted condition. 2. Replace drive.
Phase VW Short	42			
Phase UW Short	43			
Port 1-5 DPI Loss	81-86		DPI port stopped communicating. A SCANport device was connected to a drive operating DPI devices at 500k baud.	1. If adapter was not intentionally disconnected, check wiring to the port. Replace wiring, port expander, adapters, Main Control Board or complete drive as required. 2. Check HIM connection. 3. If an adapter was intentionally disconnected and the [Logic Mask] bit for that adapter is set to "1", this fault will occur. To disable this fault, set the [Logic Mask] bit for the adapter to "0."
Port 1-5 Adapter	71-76		The communications card has a fault.	Check DPI device event queue and corresponding fault information for the device.
Power Loss	3	① ③	DC bus voltage remained below 85% of nominal for longer than [Power Loss Time]. Enable/ Disable with [Fault Config 1] on page 3-29.	Monitor the incoming AC line for low voltage or line power interruption.
Power Unit	70		One or more of the output transistors were operating in the active region instead of desaturation. This can be caused by excessive transistor current or insufficient base drive voltage.	1. Check for damaged output transistors. 2. Replace drive.
Pwr Brd Chksum1	104		The checksum read from the EEPROM does not match the checksum calculated from the EEPROM data.	Clear the fault or cycle power to the drive.
Pwr Brd Chksum2	105	②	The checksum read from the board does not match the checksum calculated.	1. Cycle power to the drive. 2. If problem persists, replace drive.
Replaced MCB-PB	107	②	Main Control Board was replaced and parameters were not programmed.	1. Restore defaults. 2. Reprogram parameters.

Fault	No.	Type[1]	Description	Action
Shear Pin	63	③	Programmed [Current Lmt Val] has been exceeded. Enable/ Disable with [Fault Config 1] on page 3-29.	Check load requirements and [Current Lmt Val] setting.
SW OverCurrent	36	①	Drive output current has exceeded the 1ms current rating. This rating is greater than the 3 second current rating and less than the hardware overcurrent fault level. It is typically 200-250% of the drive continuous rating.	Check for excess load, improper DC boost setting. DC brake volts set too high.
Trnsistr OvrTemp	9	①	Output transistors have exceeded their maximum operating temperature.	1. Verify that maximum ambient temperature has not been exceeded. 2. Check fan. 3. Check for excessive load.
UnderVoltage	4	① ③	DC bus voltage fell below the minimum value of 509V DC at 600V input, 407V DC at 400/ 480V input or 204V DC at 200/ 240V input. Enable/Disable with [Fault Config 1] on page 3-29.	Monitor the incoming AC line for low voltage or power interruption.
UserSet1 Chksum	101	②	The checksum read from the user set does not match the checksum calculated.	Re-save user set.
UserSet2 Chksum	102	②		
UserSet3 Chksum	103	②		

(1) See page 4-1 for a description of fault types.

Table 4.B Fault Cross Reference

No.(1)	Fault	No.(1)	Fault	No.(1)	Fault
2	Auxiliary Input	36	SW OverCurrent	78	FluxAmpsRef Rang
3	Power Loss	38	Phase U to Grnd	79	Excessive Load
4	UnderVoltage	39	Phase V to Grnd	80	AutoTune Aborted
5	OverVoltage	40	Phase W to Grnd	81-85	Port 1-5 DPI Loss
7	Motor Overload	41	Phase UV Short	100	Parameter Chksum
8	Heatsink OvrTemp	42	Phase UW Short	101	UserSet1 Chksum
9	Trnsistr OvrTemp	43	Phase VW Short	102	UserSet2 Chksum
12	HW OverCurrent	48	Params Defaulted	103	UserSet3 Chksum
13	Ground Fault	63	Shear Pin	104	Pwr Brd Chksum1
24	Decel Inhibit	64	Drive Overload	105	Pwr Brd Chksum2
25	OverSpeed Limit	70	Power Unit	106	Incompat MCB-PB
29	Analog In Loss	71-75	Port 1-5 Adapter	107	Replaced MCB-PB
33	Auto Rstrt Tries	77	IR Volts Range	108	Anlg Cal Chksum

(1) Fault numbers not listed are reserved for future use.

Clearing Alarms

Alarms are automatically cleared when the condition that caused the alarm is no longer present.

Alarm Descriptions

Table 4.C Alarm Descriptions and Actions

Alarm	Type(1)	Description
Analog In Loss	①	An analog input is configured for “Alarm” on signal loss and signal loss has occurred.
Bipolar Conflict	②	Parameter 190 [Direction Mode] is set to “Bipolar” or “Reverse Dis” and one or more of the following digital input functions is configured: “Fwd/Reverse”, “Run Forward”, “Run Reverse”, “Jog Forward”, or “Jog Reverse”.
Decel Inhibit	①	Drive is being inhibited from decelerating.

<table>
<tr><th>Alarm</th><th>Type(1)</th><th>Description</th></tr>
<tr><td>Dig In ConflictA</td><td>②</td><td>Digital input functions are in conflict. Combinations marked with a “ ” will cause an alarm.
<table>
<tr><th></th><th>Acc2/Dec2</th><th>Accel 2</th><th>Decel 2</th><th>Jog</th><th>Jog Fwd</th><th>Jog Rev</th><th>Fwd/Rev</th></tr>
<tr><td>Acc2 / Dec2</td><td></td><td></td><td> </td><td></td><td></td><td></td><td></td></tr>
<tr><td>Accel 2</td><td> </td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Decel 2</td><td> </td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog</td><td></td><td></td><td></td><td></td><td> </td><td> </td><td></td></tr>
<tr><td>Jog Fwd</td><td></td><td></td><td></td><td> </td><td></td><td></td><td> </td></tr>
<tr><td>Jog Rev</td><td></td><td></td><td></td><td> </td><td></td><td></td><td> </td></tr>
<tr><td>Fwd / Rev</td><td></td><td></td><td></td><td></td><td> </td><td> </td><td></td></tr>
</table></td></tr>
<tr><td>Dig In ConflictB</td><td>②</td><td>A digital Start input has been configured without a Stop input or other functions are in conflict. Combinations that conflict are marked with a “ ” and will cause an alarm.
<table>
<tr><th></th><th>Start</th><th>Stop–CF</th><th>Run</th><th>Run Fwd</th><th>Run Rev</th><th>Jog</th><th>Jog Fwd</th><th>Jog Rev</th><th>Fwd/ Rev</th></tr>
<tr><td>Start</td><td></td><td></td><td> </td><td> </td><td> </td><td></td><td> </td><td> </td><td></td></tr>
<tr><td>Stop–CF</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Run</td><td></td><td></td><td></td><td> </td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Run Fwd</td><td> </td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Run Rev</td><td> </td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td> </td></tr>
<tr><td>Jog</td><td></td><td></td><td></td><td> </td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Fwd</td><td> </td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Rev</td><td> </td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Fwd / Rev</td><td></td><td></td><td></td><td> </td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Dig In ConflictC</td><td>②</td><td>More than one physical input has been configured to the same input function. Multiple configurations are not allowed for the following input functions.

Forward/Reverse
Speed Select 1
Speed Select 2
Speed Select 3
Run Forward
Run Reverse
Jog Forward
Jog Reverse
Run
Stop Mode B
Bus Regulation Mode B
Acc2 / Dec2
Accel 2
Decel 2</td></tr>
<tr><td>Drive OL Level 1</td><td>①</td><td>The calculated IGBT temperature requires a reduction in PWM frequency. If [Drive OL Mode] is disabled and the load is not reduced, an overload fault will eventually occur.</td></tr>
<tr><td>Drive OL Level 2</td><td>①</td><td>The calculated IGBT temperature requires a reduction in Current Limit. If [Drive OL Mode] is disabled and the load is not reduced, an overload fault will eventually occur.</td></tr>
<tr><td>FluxAmpsRef Rang</td><td>②</td><td>The calculated or measured Flux Amps value is not within the expected range. Verify motor data and rerun motor tests.</td></tr>
<tr><td>IntDBRes OvrHeat</td><td>①</td><td>The drive has temporarily disabled the DB regulator because the resistor temperature has exceeded a predetermined value.</td></tr>
<tr><td>IR Volts Range</td><td>②</td><td>The drive auto tuning default is “Calculate” and the value calculated for IR Drop Volts is not in the range of acceptable values. This alarm should clear when all motor nameplate data is properly entered.</td></tr>
</table>

Alarm	Type(1)	Description
MaxFreq Conflict	②	The sum of [Maximum Speed] and [Overspeed Limit] exceeds [Maximum Freq]. Raise [Maximum Freq] or lower [Maximum Speed] and/or [Overspeed Limit] so that the sum is less than or equal to [Maximum Freq].
Motor Type Cflct	②	[Motor Type] has been set to "Synchr Reluc" or "Synchr PM" and one or more of the following exist: • [Torque Perf Mode] = "Sensrls Vect," "SV Economize" or "Fan/Pmp V/Hz." • [Flux Up Time] is greater than 0.0 Secs. • [Speed Mode] is set to "Slip Comp." • [Autotune] = "Static Tune" or "Rotate Tune."
NP Hz Conflict	②	Fan/pump mode is selected in [Torq Perf Mode] and the ratio of [Motor NP Hertz] to [Maximum Freq] is greater than 26.
Power Loss	①	Drive has sensed a power line loss.
Prechrg Active	①	Drive is in the initial DC bus precharge state.
Speed Ref Cflct	②	[Speed Ref x Sel] or [PI Reference Sel] is set to "Reserved".
Start At PowerUp	①	[Start At PowerUp] is enabled. Drive may start at any time within 10 seconds of drive powerup.
UnderVoltage	①	The bus voltage has dropped below a predetermined value.
VHz Neg Slope	②	[Torq Perf Mode] = "Custom V/Hz" and the V/Hz slope is negative.

(1) See page 4-1 for a description of alarm types.

Table 4.D Alarm Cross Reference

No.(1)	Alarm
1	Precharge Active
2	UnderVoltage
3	Power Loss
4	Start At PowerUp
5	Analog in Loss
6	IntDBRes OvrHeat
8	Drive OL Level 1

No.(1)	Alarm
9	Drive OL Level 2
10	Decel Inhibt
17	Dig In ConflictA
18	Dig In ConflictB
19	Dig In ConflictC
20	Bipolar Conflict
21	Motor Type Cflct

No.(1)	Alarm
22	NP Hz Conflict
23	MaxFreq Conflict
24	VHz Neg Slope
25	IR Volts Range
26	FluxAmpsRef Rang
27	Speed Ref Cflct

(1) Alarm numbers not listed are reserved for future use.

Testpoint Codes and Functions

Code Selected in [Testpoint x Sel]	Function Whose Value is Displayed in [Testpoint x Data]
1	DPI Error Status
2	Heatsink Temperature
3	Active Current Limit
4	Active PWM Frequency
5	Lifetime MegaWatt Hours(1)
6	Lifetime Run Time
7	Lifetime Powered Up Time
8	Lifetime Power Cycles
9	Life MegaWatt Hours Fraction(1)
10	Life MegaWatt Hours Fraction Units(1)
11-99	Reserved for Factory Use

(1) Use the equation below to calculate total Lifetime MegaWatt Hours.

$$\left(\frac{\text{Value of Code 9}}{\text{Value of Code 10}} \times 0.1\right) + \text{Value of Code 5} = \text{Total Lifetime MegaWatt Hours}$$

Common Symptoms and Corrective Actions

Drive does not Start from Start or Run Inputs wired to the terminal block.

Cause(s)	Indication	Corrective Action
Drive is Faulted	Flashing red status light	Clear fault. • Press Stop • Cycle power • Set [Fault Clear] to 1 (See page 3-29) • "Clear Faults" on the HIM Diagnostic menu
Incorrect input wiring. See page 1-15 for wiring examples. • 2 wire control requires Run, Run Forward, Run Reverse or Jog input. • 3 wire control requires Start and Stop inputs • Jumper from terminal 7 to 8 is required.	None	Wire inputs correctly and/or install jumper.
Incorrect digital input programming. • Mutually exclusive choices have been made (i.e., Jog and Jog Forward). • 2 wire and 3 wire programming may be conflicting. • Exclusive functions (i.e, direction control) may have multiple inputs configured. • Stop is factory default and is not wired.	None	Program [Digital Inx Sel] for correct inputs. (See page 3-37) Start or Run programming may be missing.
	Flashing yellow status light and "DigIn CflctB" indication on LCD HIM. [Drive Status 2] shows type 2 alarm(s).	Program [Digital Inx Sel] to resolve conflicts. (See page 3-37) Remove multiple selections for the same function. Install stop button to apply a signal at stop terminal.

Drive does not Start from HIM.

Cause(s)	Indication	Corrective Action
Drive is programmed for 2 wire control. HIM Start button is disabled for 2 wire control.	None	If 2 wire control is required, no action is necessary. If 3 wire control is required, program [Digital Inx Sel] for correct inputs. (See page 3-37)

Drive does not respond to changes in speed command.

Cause(s)	Indication	Corrective Action
No value is coming from the source of the command.	LCD HIM Status Line indicates "At Speed" and output is 0 Hz.	1. If the source is an analog input, check wiring and use a meter to check for presence of signal. 2. Check [Commanded Freq] for correct source. (Param #002, page 3-8)
Incorrect reference source has been programmed.	None	3. Check [Speed Ref Source] for the source of the speed reference. (Param #213, page 3-26) 4. Reprogram [Speed Ref A Sel] for correct source. (Param #090, page 3-14)
Incorrect Reference source is being selected via remote device or digital inputs.	None	5. Check [Drive Status 1], bits 12 and 13 for unexpected source selections. (Param #209, page 3-25) 6. Check [Dig In Status] to see if inputs are selecting an alternate source. (Param #216, page 3-27) 7. Reprogram digital inputs to correct "Speed Sel x" option. (See page 3-37)

Motor and/or drive will not accelerate to commanded speed.

Cause(s)	Indication	Corrective Action
Acceleration time is excessive.	None	Reprogram [Accel Time x]. (See page 3-18)
Excess load or short acceleration times force the drive into current limit, slowing or stopping acceleration.	None	Check [Drive Status 2], bit 10 to see if the drive is in Current Limit. (See page 3-25) Remove excess load or reprogram [Accel Time x]. (See page 3-18)
Speed command source or value is not as expected.	None	Check for the proper Speed Command using Steps 1 through 7 above.
Programming is preventing the drive output from exceeding limiting values.	None	Check [Maximum Speed] (Param #082, page 3-12) and [Maximum Freq] (Param #055, page 3-10) to assure that speed is not limited by programming.

Motor operation is unstable.

Cause(s)	Indication	Corrective Action
Motor data was incorrectly entered or Autotune was not performed.	None	1. Correctly enter motor nameplate data. 2. Perform “Static” or “Rotate” Autotune procedure. (Param #061, page 3-11)

Drive will not reverse motor direction.

Cause(s)	Indication	Corrective Action
Digital input is not selected for reversing control.	None	Check [Digital Inx Sel] (See page 3-37). Choose correct input and program for reversing mode.
Digital input is incorrectly wired.	None	Check input wiring. (See page 1-14)
Direction mode parameter is incorrectly programmed.	None	Reprogram [Direction Mode] for analog “Bipolar” or digital “Unipolar” control. (Param #190, page 3-23)
Motor wiring is improperly phased for reverse.	None	Switch two motor leads.
A bipolar analog speed command input is incorrectly wired or signal is absent.	None	1. Use meter to check that an analog input voltage is present. 2. Check wiring. (See page 1-15) Positive voltage commands forward direction. Negative voltage commands reverse direction.

Stopping the drive results in a Decel Inhibit fault.

Cause(s)	Indication	Corrective Action
The bus regulation feature is enabled and is halting deceleration due to excessive bus voltage. Excess bus voltage is normally due to excessive regenerated energy or unstable AC line input voltages. Internal timer has halted drive operation.	Decel Inhibit fault screen. LCD Status Line indicates “Faulted”.	1. See Attention statement on Preface-4. 2. Reprogram bus regulation (parameters 161 and 162) to eliminate any “Adjust Freq” selection. 3. Disable bus regulation (parameters 161 and 162) and add a dynamic brake. 4. Correct AC input line instability or add an isolation transformer. 5. Reset drive.

Supplemental Drive Information

For information on…	See page…
Specifications	A-1
Communication Configurations	A-3
Dimensions	A-6
Output Devices	A-11
Drive, Fuse & Circuit Breaker Ratings	A-11

Specifications

Category	Specification						
Protection	**Drive**	**200-208V**	**240V**	**380/400**	**480V**	**600V**	**690V**
	AC Input Overvoltage Trip:	247V AC	285V AC	475V AC	570V AC	690V AC	
	AC Input Undervoltage Trip:	120V AC	138V AC	233V AC	280V AC	345V AC	
	Bus Overvoltage Trip:	405V DC	405V DC	810V DC	810V DC	1013V DC	
	Bus Undervoltage Output Shutoff:	300V DC	300V DC	407V DC	407V DC	508V DC	
	Bus Undervoltage Fault Level:	160V DC	160V DC	300V DC	300V DC	375V DC	
	Nominal Bus Voltage:	281V DC	324V DC	540V DC	648V DC	810V DC	
	All Drives						
	Heat Sink Thermistor:	Monitored by microprocessor overtemp trip					
	Drive Overcurrent Trip Software Current Limit: Hardware Current Limit: Instantaneous Current Limit:	 20-160% of rated current 200% of rated current (typical) 220-300% of rated current (dependent on drive rating)					
	Line transients:	up to 6000 volts peak per IEEE C62.41-1991					
	Control Logic Noise Immunity:	Showering arc transients up to 1500V peak					
	Power Ride-Thru:	15 milliseconds at full load					
	Logic Control Ride-Thru:	0.5 seconds minimum, 2 seconds typical					
	Ground Fault Trip:	Phase-to-ground on drive output					
	Short Circuit Trip:	Phase-to-phase on drive output					
Environment	Altitude:	1000 m (3300 ft) max. without derating					
	Maximum Surrounding Air Temperature without derating: Open Type, IP20, NEMA Type 1 and Flange Mount: IP66 and NEMA Type 4X/12:	 0 to 50 degrees C (32 to 122 degrees F) 0 to 40 degrees C (32 to 104 degrees F)					
	Storage Temperature (all const.):	–40 to 70 degrees C (–40 to 158 degrees F)					
	Atmosphere	**Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.					
	Relative Humidity:	5 to 95% non-condensing					
	Shock:	15G peak for 11ms duration (±1.0 ms)					
	Vibration:	0.152 mm (0.006 in.) displacement, 1G peak					

Category	Specification				
Agency Certification	**Type 1, IP30**	**Flange Type**	**Type 4X/12, IP66**		
	✔	✔	✔	c UL us	Listed to UL508C and CAN/CSA-C2.2 No. 14-M91
		✔			Listed to UL508C for plenums (Rear heatsink only)
	✔	✔	✔	CE	Marked for all applicable European Directives (1) EMC Directive (89/336/EEC) EN 61800-3 Adjustable Speed electrical power drive systems Low Voltage Directive (73/23/EEC) EN 50178 Electronic Equipment for use in Power Installations
	✔	✔	✔	N223	Certified to AS/NZS, 1997 Group 1, Class A
			✔	NSF	Certified to Criteria C-2, 1983.
	The drive is also designed to meet the appropriate portions of the following specifications: NFPA 70 - US National Electrical Code NEMA ICS 3.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems. IEC 146 - International Electrical Code.				
Electrical	Voltage Tolerance:				See page C-12 for Full Power and Operating Range.
	Frequency Tolerance:				47-63 Hz.
	Input Phases:				Three-phase input provides full rating for all drives. Single-phase operation provides 50% of rated current.
	Displacement Power Factor				0.98 across speed range.
	Efficiency:				97.5% at rated amps, nominal line volts.
	Maximum Short Circuit Rating:				200,000 Amps symmetrical.
	Actual Short Circuit Rating:				Determined by AIC rating of installed fuse/circuit breaker.
Control	Method:				Sine coded PWM with programmable carrier frequency. Ratings apply to all drives. The drive can be supplied as 6 pulse or 12 pulse in a configured package.
	Carrier Frequency				2, 4, 8 & 10 kHz. Drive rating based on 4 kHz
	Output Voltage Range:				0 to rated motor voltage
	Output Frequency Range:				0 to 400 Hz.
	Frequency Accuracy Digital Input: Analog Input:				 Within ±0.01% of set output frequency. Within ±0.4% of maximum output frequency.
	Speed Regulation - Open Loop with Slip Compensation:				±0.5% of base speed across a 40:1 speed range.
	Selectable Motor Control:				Sensorless Vector with full tuning. Standard V/Hz with full custom capability and vector control.
	Stop Modes:				Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.
	Accel/Decel:				Two independently programmable accel & decel times. Each time may be programmed from 0-3600 seconds in 0.1 sec. increments
	Intermittent Overload:				110% Overload capability for up to 1 minute 150% Overload capability for up to 3 seconds
	Current Limit Capability:				Proactive Current Limit programmable from 20 to 160% of rated output current. Independently programmable proportional and integral gain.
	Electronic Motor Overload Protection				Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12.

(1) Applied noise impulses may be counted in addition to the standard pulse train causing erroneously high [Pulse Freq] readings.

Category	Specification	
Control	Method:	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives. The drive can be supplied as 6 pulse or 12 pulse in a configured package.
	Carrier Frequency	2, 4, 8 & 10 kHz. Drive rating based on 4 kHz
	Output Voltage Range:	0 to rated motor voltage
	Output Frequency Range:	0 to 400 Hz.
	Frequency Accuracy Digital Input: Analog Input:	 Within ±0.01% of set output frequency. Within ±0.4% of maximum output frequency.
	Speed Regulation - Open Loop with Slip Compensation:	±0.5% of base speed across a 40:1 speed range.
	Selectable Motor Control:	Sensorless Vector with full tuning. Standard V/Hz with full custom capability and vector control.
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.
	Accel/Decel:	Two independently programmable accel & decel times. Each time may be programmed from 0-3600 seconds in 0.1 sec. increments
	Intermittent Overload:	110% Overload capability for up to 1 minute 150% Overload capability for up to 3 seconds
	Current Limit Capability:	Proactive Current Limit programmable from 20 to 160% of rated output current. Independently programmable proportional and integral gain.
	Electronic Motor Overload Protection	Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12.

Communication Configurations

Typical Programmable Controller Configurations

Important: If block transfers are programmed to continuously write information to the drive, care must be taken to properly format the block transfer. If attribute 10 is selected for the block transfer, values will be written only to RAM and will not be saved by the drive. This is the preferred attribute for continuous transfers. If attribute 9 is selected, each program scan will complete a write to the drives non-volatile memory (EEprom). Since the EEprom has a fixed number of allowed writes, continuous block transfers will quickly damage the EEprom. Do Not assign attribute 9 to continuous block transfers. Refer to the individual communications adapter User Manual for additional details.

Logic Command/Status Words

Figure A.1 Logic Command Word

Logic Bits																
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Command**	**Description**
															x	Stop[1]	0 = Not Stop 1 = Stop
														x		Start[1] [2]	0 = Not Start 1 = Start
													x			Jog	0 = Not Jog 1 = Jog
												x				Clear Faults	0 = Not Clear Faults 1 = Clear Faults
										x	x					Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Present Direction
									x							Local Control	0 = No Local Control 1 = Local Control
								x								MOP Increment	0 = Not Increment 1 = Increment
						x	x									Accel Rate	00 = No Command 01 = Use Accel Time 1 10 = Use Accel Time 2 11 = Use Present Time
				x	x											Decel Rate	00 = No Command 01 = Use Decel Time 1 10 = Use Decel Time 2 11 = Use Present Time
	x	x	x													Reference Select[3]	000 = No Command 001 = Ref. 1 (Ref A Select) 010 = Ref. 2 (Ref B Select) 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
x																MOP Decrement	0 = Not Decrement 1 = Decrement

(1) A “0 = Not Stop” condition (logic 0) must first be present before a “1 = Start” condition will start the drive. The Start command acts as a momentary Start command. A “1” will start the drive, but returning to “0” will not stop the drive.

(2) This Start will not function if a digital input (parameters 361-366) is programmed for 2-Wire Control (option 7, 8 or 9).

(3) This Reference Select will not function if a digital input (parameters 361-366) is programmed for “Speed Sel 1, 2 or 3” (option 15, 16 or 17). Note that Reference Selection is “Exclusive Ownership” see [Reference Owner] on page 3-33.

Figure A.2 Logic Status Word

Logic Bits																
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Status**	**Description**
															x	Ready	0 = Not Ready 1 = Ready
														x		Active	0 = Not Active 1 = Active
													x			Command Direction	0 = Reverse 1 = Forward
												x				Actual Direction	0 = Reverse 1 = Forward
											x					Accel	0 = Not Accelerating 1 = Accelerating
										x						Decel	0 = Not Decelerating 1 = Decelerating
									x							Alarm	0 = No Alarm 1 = Alarm
								x								Fault	0 = No Fault 1 = Fault
							x									At Speed	0 = Not At Reference 1 = At Reference
				x	x	x										Local Control[1]	000 = Port 0 (TB) 001 = Port 1 010 = Port 2 011 = Port 3 100 = Port 4 101 = Port 5 110 = Port 6 111 = No Local
x	x	x	x													Reference Source	0000 = Ref A Auto 0001 = Ref B Auto 0010 = Preset 2 Auto 0011 = Preset 3 Auto 0100 = Preset 4 Auto 0101 = Preset 5 Auto 0110 = Preset 6 Auto 0111 = Preset 7 Auto 1000 = Term Blk Manual 1001 = DPI 1 Manual 1010 = DPI 2 Manual 1011 = DPI 3 Manual 1100 = DPI 4 Manual 1101 = DPI 5 Manual 1110 = DPI 6 Manual 1111 = Jog Ref

(1) See “Owners” on page 3-33 for further information.

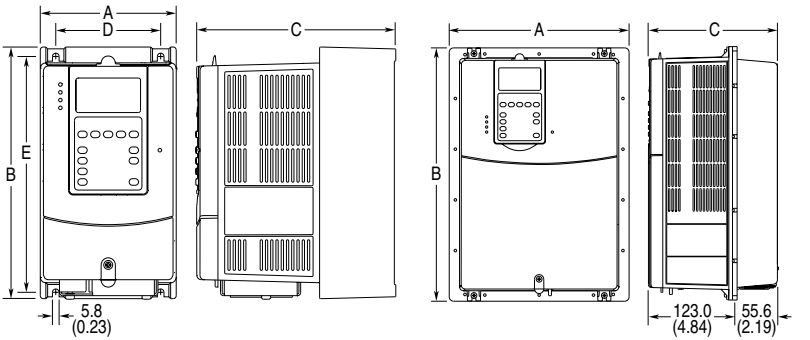
Dimensions

Table A.A PowerFlex 70 Frames

Output Power		Frame Size								
		208-240V AC Input			400-480V AC Input			600V AC Input		
kW ND (HD)	HP ND (HD)	Not Filtered	Filtered	IP66 (4X/12)	Not Filtered	Filtered	IP66 (4X/12)	Not Filtered	Filtered	IP66 (4X/12)
0.37 (0.25)	0.5 (0.33)	A	B	B	A	B	B	A	–	B
0.75 (0.55)	1 (0.75)	A	B	B	A	B	B	A	–	B
1.5 (1.1)	2 (1.5)	B	B	B	A	B	B	A	–	B
2.2 (1.5)	3 (2)	B	B	B	B	B	B	B	–	B
4 (3)	5 (3)	–	C	D	B	B	B	B	–	B
5.5 (4)	7.5 (5)	–	D	D	–	C	D	C	–	D
7.5 (5.5)	10 (7.5)	–	D	D	–	C	D	C	–	D
11 (7.5)	15 (10)	–	–	–	–	D	D	D	–	D
15 (11)	20 (15)	–	–	–	–	D	D	D	–	D

Figure A.3 PowerFlex 70 Frames A-D

IP20/66 (NEMA Type 1/4X/12) **Flange Mount**



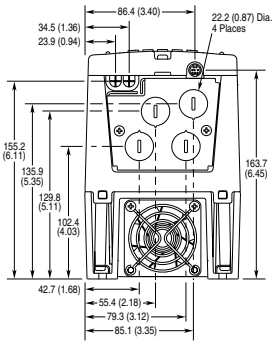
Dimensions are in millimeters and (inches).

Frame (see Table A.A)	A	B	C	D	E	Weight (1) kg (lbs.)
IP20 / NEMA Type 1						
A	122.4 (4.82)	225.7 (8.89)	179.8 (7.08)	94.2 (3.71)	211.6 (8.33)	2.71 (6.0)
B	171.7 (6.76)	234.6 (9.24)	179.8 (7.08)	122.7 (4.83)	220.2 (8.67)	3.60 (7.9)
C	185.0 (7.28)	300.0 (11.81)	179.8 (7.08)	137.6 (5.42)	285.6 (11.25)	6.89 (15.2)
D	219.9 (8.66)	350.0 (13.78)	179.8 (7.08)	169.0 (6.65)	335.6 (13.21)	9.00 (19.8)
IP66 / NEMA Type 4X/12						
B	171.7 (6.76)	239.8 (9.44)	203.3 (8.00)	122.7 (4.83)	220.2 (8.67)	3.61 (8.0)
D	219.9 (8.66)	350.0 (13.78)	210.7 (8.29)	169.0 (6.65)	335.6 (13.21)	9.13 (20.1)
Flange Mount						
A	156.0 (6.14)	225.8 (8.89)	178.6 (7.03)	–	–	2.71 (6.0)
B	205.2 (8.08)	234.6 (9.24)	178.6 (7.03)	–	–	3.60 (7.9)
C	219.0 (8.62)	300.0 (11.81)	178.6 (7.03)	–	–	6.89 (15.2)
D	248.4 (9.78)	350.0 (13.78)	178.6 (7.03)	–	–	9.00 (19.8)

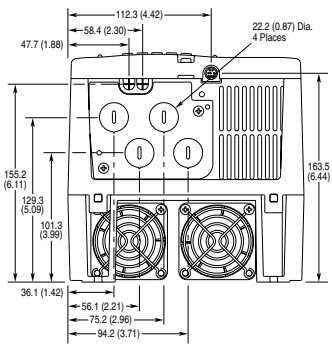
(1) Weights include HIM and Standard I/O.

Figure A.4 PowerFlex 70 IP20 / NEMA Type 1 Bottom View Dimensions

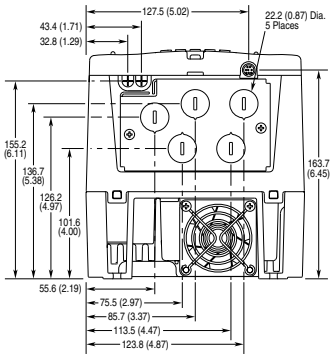
Frame A



Frame C



Frame B



Frame D

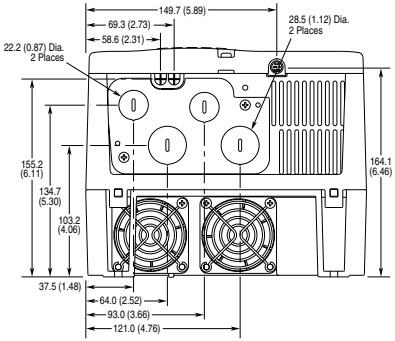
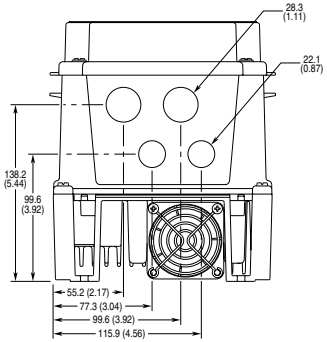
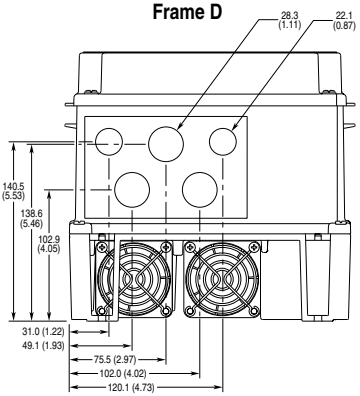


Figure A.5 PowerFlex 70 IP 66 (NEMA Type 4X/12) Bottom View Dimensions

Frame B

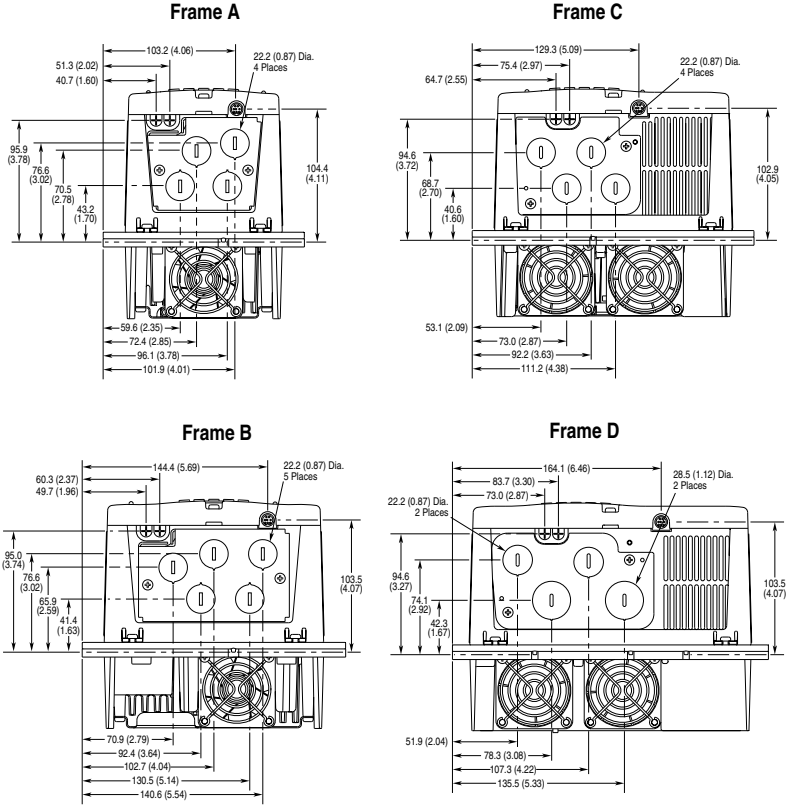


Frame D



Dimensions are in millimeters and (inches).

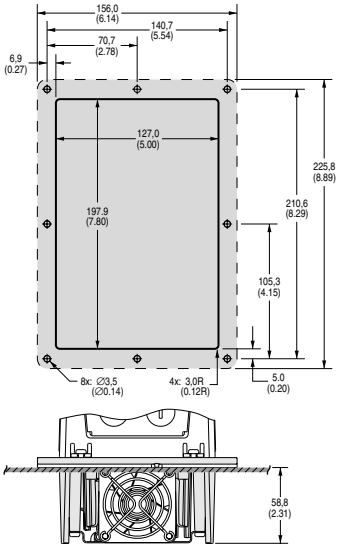
Figure A.6 PowerFlex 70 Flange Mount Bottom View Dimensions



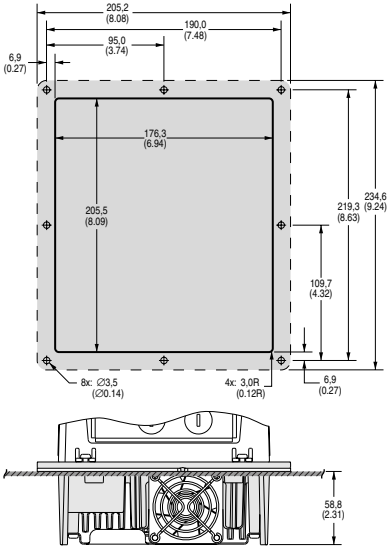
Dimensions are in millimeters and (inches).

Figure A.7 PowerFlex 70 Cutout Dimensions

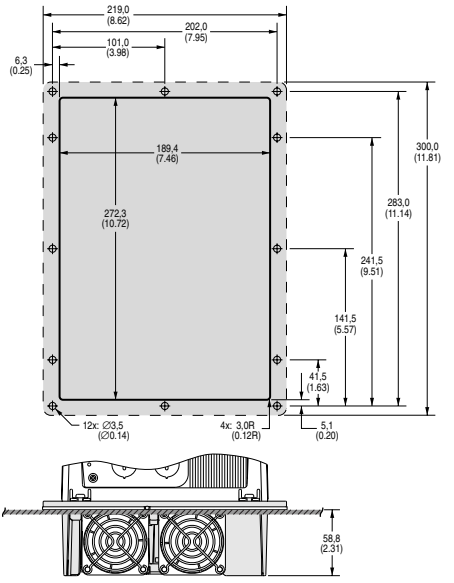
Frame A



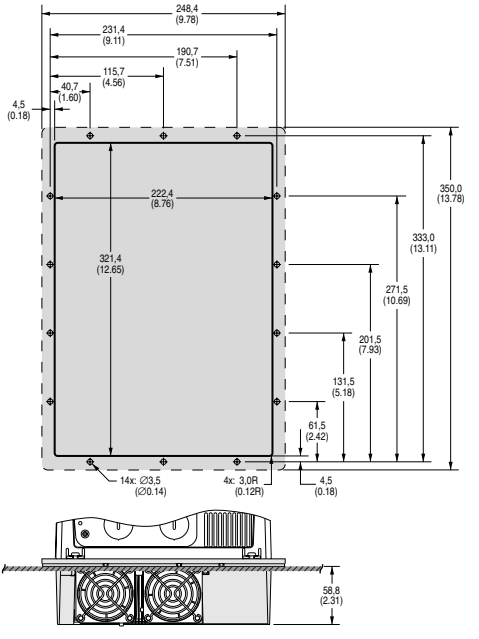
Frame B



Frame C



Frame D



Output Devices

For information on output devices such as output contactors, cable terminators and output reactors refer to the *PowerFlex Reference Manual*.

Drive, Fuse & Circuit Breaker Ratings

The tables on the following pages provide drive ratings (including continuous, 1 minute and 3 second) and recommended AC line input fuse and circuit breaker information. Both types of short circuit protection are acceptable for UL and IEC requirements. Sizes listed are the recommended sizes based on 40 degree C and the U.S. N.E.C. Other country, state or local codes may require different ratings.

Fusing

If fuses are chosen as the desired protection method, refer to the recommended types listed below. If available amp ratings do not match the tables provided, the closest fuse rating that exceeds the drive rating should be chosen.

- IEC – BS88 (British Standard) Parts 1 & 2[(1)], EN60269-1, Parts 1 & 2, type gG or equivalent should be used.
- UL – UL Class CC, T, RK1 or J must be used.

Circuit Breakers

The "non-fuse" listings in the following tables include both circuit breakers (inverse time or instantaneous trip) and 140M Self-Protecting Motor Starters. **If one of these is chosen as the desired protection method**, the following requirements apply.

- IEC and UL – Both types of devices are acceptable for IEC and UL installations.

(1) Typical designations include, but may not be limited to the following; Parts 1 & 2: AC, AD, BC, BD, CD, DD, ED, EFS, EF, FF, FG, GF, GG, GH.

Table A.B 208/240 Volt AC Input Protection Devices

Drive Catalog Number	Frame[1]	HP Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker[4]	Motor Circuit Protector[6]	140M Motor Starter with Adjustable Current Range[7] [8]			
		ND	*HD*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.[2]*	*Max.[3]*	*Min.[2]*	*Max.[3]*	*Max.[5]*	*Max.[5]*	*Available Catalog Numbers[9]*			
208 Volt AC Input																		
20AB2P2	A	0.5	0.33	2.9	1.1	2.5	2.7	3.7	6	6	6	10	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AB4P2	A	1	0.75	5.6	2	4.8	5.5	7.4	10	10	10	17.5	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AB6P8	B	2	1.5	10	3.6	7.8	10.3	13.8	15	15	15	30	30	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AB9P6	B	3	2	14	5.1	11	12.1	16.5	20	25	20	40	40	30	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB015	C	5	3	16	5.8	17.5	19.2	26.6	20	35	20	70	70	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AB022	D	7.5	5	23.3	8.3	25.3	27.8	37.9	30	50	30	100	100	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140M-CMN-2500
20AB028	D	10	7.5	29.8	10.7	32.2	37.9	50.6	40	70	40	125	125	50	–	–	140M-F8E-C32	140M-CMN-4000
240 Volt AC Input																		
20AB2P2	A	0.5	0.33	2.5	1.1	2.2	2.4	3.3	3	4.5	3	8	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AB4P2	A	1	0.75	4.8	2	4.2	4.8	6.4	6	9	6	15	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AB6P8	B	2	1.5	8.7	3.6	6.8	9	12	15	15	15	25	25	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AB9P6	B	3	2	12.2	5.1	9.6	10.6	14.4	20	20	20	35	35	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB015	C	5	3	13.9	5.8	15.3	17.4	23.2	20	30	20	60	60	30	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB022	D	7.5	5	19.9	8.3	22	24.4	33	25	45	25	80	80	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AB028	D	10	7.5	25.7	10.7	28	33	44	35	60	35	110	110	50	–	–	140M-F8E-C32	140M-CMN-4000

See page A-14 for Notes.

Table A.C 400/480 Volt AC Input Protection Devices

Drive Catalog Number	Frame[1]	kW (400V) HP (480V) Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker[4]	Motor Circuit Protector[6]	140M Motor Starter with Adjustable Current Range[7] [8]			
		ND	*HD*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.[2]*	*Max.[3]*	*Min.[2]*	*Max.[3]*	*Max.[5]*	*Max.[5]*	*Available Catalog Numbers[9]*			
400 Volt AC Input																		
20AC1P3	A	0.37	0.25	1.6	1.1	1.3	1.4	1.9	3	3	3	5	15	3	140M-C2E-B16	–	–	–
20AC2P1	A	0.75	0.55	2.5	1.8	2.1	2.4	3.2	4	6	4	8	15	7	140M-C2E-B25	140M-D8E-B25	–	–
20AC3P5	A	1.5	1.1	4.3	3	3.5	4.5	6	6	6	6	12	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AC5P0	B	2.2	1.5	6.5	4.5	5	5.5	7.5	10	10	10	20	20	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AC8P7	B	4	3	11.3	7.8	8.7	9.9	13.2	15	17.5	15	30	30	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC011	C	5.5	4	11	7.6	11.5	13	17.4	15	25	15	45	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC015	C	7.5	5.5	15.1	10.4	15.4	17.2	23.1	20	30	20	60	60	20	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC022	D	11	7.5	21.9	15.2	22	24.2	33	30	45	30	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140M-CMN-2500
20AC030	D	15	11	30.3	21	30	33	45	40	60	40	120	120	50	–	–	140M-F8E-C32	140M-CMN-4000
480 Volt AC Input																		
20AD1P1	A	0.5	0.33	1.3	1.1	1.1	1.2	1.6	3	3	3	4	15	3	140M-C2E-B16	–	–	–
20AD2P1	A	1	0.75	2.4	2	2.1	2.4	3.2	3	6	3	8	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AD3P4	A	2	1.5	3.8	3.2	3.4	4.5	6	6	6	6	12	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AD5P0	B	3	2	5.6	4.7	5	5.5	7.5	10	10	10	20	20	15	140M-C2E-C63	140M-D8E-B63	–	–
20AD8P0	B	5	3	9.8	8.4	8	8.8	12	15	15	15	30	30	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AD011	C	7.5	5	9.5	7.9	11	12.1	16.5	15	20	15	40	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AD014	C	10	7.5	12.5	10.4	14	16.5	22	20	30	20	50	50	20	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AD022	D	15	10	19.9	16.6	22	24.2	33	25	45	25	80	80	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AD027	D	20	15	24.8	20.6	27	33	44	35	60	35	100	100	50	–	–	140M-F8E-C25	140M-CMN-2500

See page A-14 for Notes.

Table A.D 600 Volt AC Input Protection Devices

Drive Catalog Number	Frame[1]	HP Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker[4]	Motor Circuit Protector[6]	140M Motor Starter with Adjustable Current Range[7] [8]			
		ND	*HD*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.[2]*	*Max.[3]*	*Min.[2]*	*Max.[3]*	*Max.[5]*	*Max.[5]*	*Available Catalog Numbers[9]*			
600 Volt AC Input																		
20AE0P9	A	0.5	0.33	1.3	1.3	0.9	1.1	1.4	3	3	3	3.5	15	3	140M-C2E-B16	–	–	–
20AE1P7	A	1	0.75	1.9	2	1.7	2	2.6	3	6	3	6	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AE2P7	A	2	1.5	3	3.1	2.7	3.6	4.8	4	6	4	10	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AE3P9	B	3	2	4.4	4.5	3.9	4.3	5.9	6	8	6	15	15	7	140M-C2E-C63	140M-D8E-B63	–	–
20AE6P1	B	5	3	7.5	7.8	6.1	6.7	9.2	10	12	10	20	20	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AE9P0	C	7.5	5	7.7	8	9	9.9	13.5	10	20	10	35	35	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AE011	C	10	7.5	9.8	10.1	11	13.5	18	15	20	15	40	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AE017	D	15	10	15.3	15.9	17	18.7	25.5	20	35	20	60	60	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AE022	D	20	15	20	20.8	22	25.5	34	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140M-CMN-2500

(1) For IP 66 (NEMA Type 4X/12) enclosures, drives listed as Frame A increase to Frame B and drives listed as Frame C increase to Frame D.

(2) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.

(3) Maximum protection device size is the highest rated device that supplies drive protection. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.

(4) Circuit Breaker - inverse time breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.

(5) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.

(6) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.

(7) Bulletin 140M with adjustable current range should have the current trip set to the minimum range that the device will not trip.

(8) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 208 Wye or Delta, 240 Wye or Delta, 480Y/277 or 600Y/347. Not UL listed for use on 480V or 600V Delta/Delta systems.

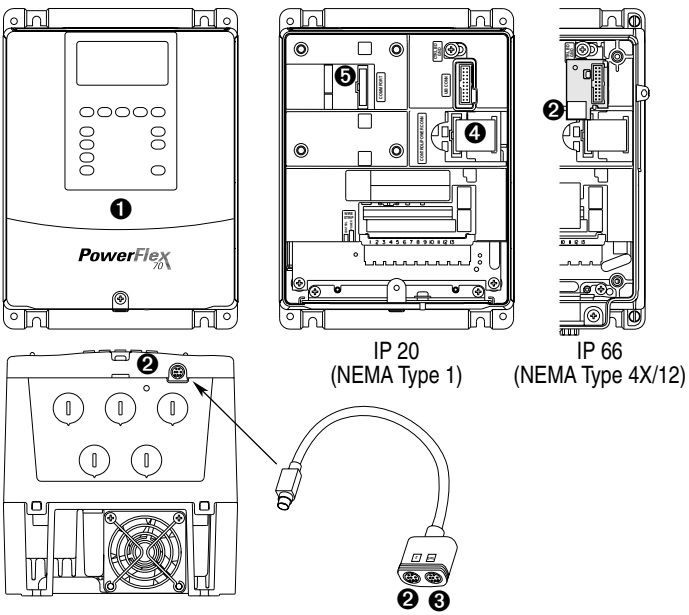
(9) The AIC ratings of the Bulletin 140M Motor Protector may vary. See publication 140M-SG001B-EN-P.

HIM Overview

For information on…	See page	For information on…	See page
External and Internal Connections	B-1	Menu Structure	B-3
LCD Display Elements	B-2	Viewing and Editing Parameters	B-5
ALT Functions	B-2	Removing the HIM	B-2

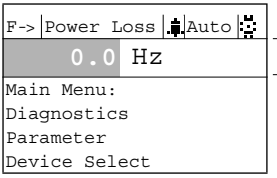
External and Internal Connections

The PowerFlex 70 provides a number of cable connection points (B Frame shown).



No.	Connector	Description
❶	DPI Port 1	HIM connection when installed in cover.
❷	DPI Port 2	Cable connection for handheld and remote options.
❸	DPI Port 3	Splitter cable connected to DPI Port 2 provides additional port.
❹	Control / Power Connection	Connection between control and power boards.
❺	DPI Port 5	Cable connection for communications adapter.

LCD Display Elements

Display	Description
	Direction | Drive Status | Alarm | Auto/Man | Information Commanded or Output Frequency Programming / Monitoring / Troubleshooting

ALT Functions

To use an ALT function, press the ALT key, release it, then press the programming key associated with one of the following functions:

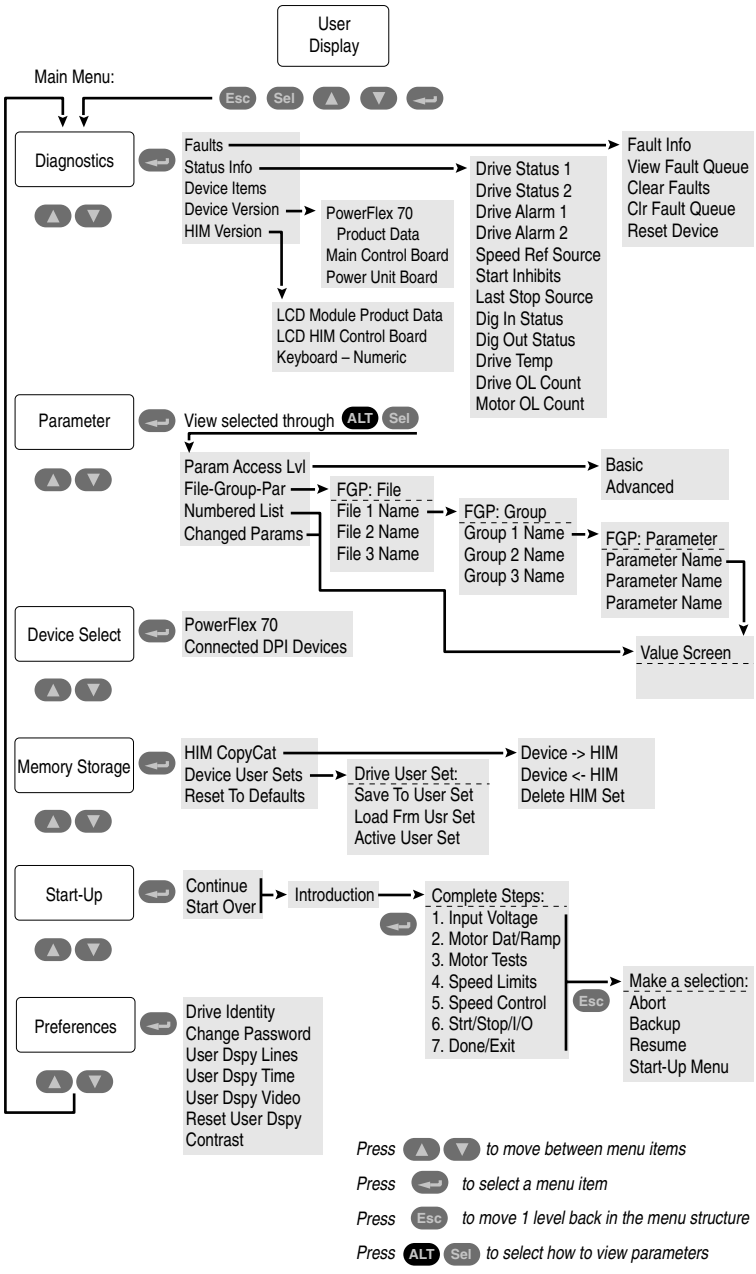
ALT Key and then ...			Performs this function ...	HIM Type
ALT	Esc	S.M.A.R.T.	Displays the S.M.A.R.T. screen.	LCD only
	Esc	Log In/Out	Log in to change parameter settings. Log out to protect parameter settings. Change a password.	LED only
	Sel	View	Allows the selection of how parameters will be viewed or detailed information about a parameter or component.	LCD only
	Sel	Device	Select a connected adapter for editing.	LED only
	▲	Lang	Displays the language selection screen.	LCD only
	▼	Auto / Man	Switches between Auto and Manual Modes.	LCD and LED
	↵	Remove	Allows HIM removal without causing a fault if the HIM is not the last controlling device and does not have Manual control of the drive.	LCD and LED
	.	Exp	Allows value to be entered as an exponent. (Not available on PowerFlex 70.)	LCD only
	+/–	Param #	Allows entry of a parameter number for viewing/ editing.	LCD only

Removing the HIM

The HIM can be removed while the drive is powered. Normally, the drive issues a fault when the HIM is removed because it detects that a device is missing.

Important: HIM removal is only permissible in Auto mode. If the HIM is removed while in Manual mode or the HIM is the only remaining control device, a fault will occur.

Menu Structure



Diagnostics Menu

When a fault trips the drive, use this menu to access detailed data about the drive.

Option	Description
Faults	View fault queue or fault information, clear faults or reset drive.
Status Info	View parameters that display status information about the drive.
Device Version	View the firmware version and hardware series of components.
HIM Version	View the firmware version and hardware series of the HIM.

Parameter Menu

Refer to Viewing and Editing Parameters on page B-5.

Device Select Menu

Use this menu to access parameters in connected peripheral devices.

Memory Storage Menu

Drive data can be saved to, or recalled from, User and HIM sets.
User sets are files stored in permanent nonvolatile drive memory.
HIM sets are files stored in permanent nonvolatile HIM memory.

Option	Description
HIM Copycat Device -> HIM Device <- HIM	Save data to a HIM set, load data from a HIM set to active drive memory or delete a HIM set.
Device User Sets	Save data to a User set, load data from a User set to active drive memory or name a User set.
Reset To Defaults	Restore the drive to its factory-default settings.

Start Up Menu

See Chapter 2.

Preferences Menu

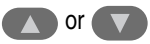
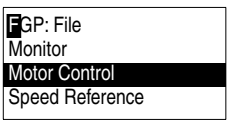
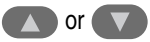
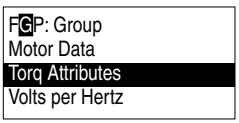
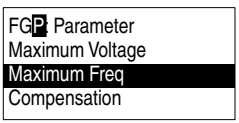
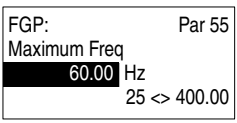
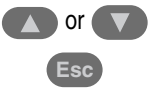
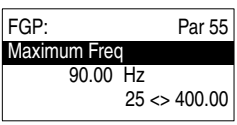
The HIM and drive have features that you can customize.

Option	Description
Drive Identity	Add text to identify the drive.
Change Password	Enable/disable or modify the password.
User Dspy Lines	Select the display, parameter, scale and text for the User Display. The User Display is two lines of user-defined data that appears when the HIM is not being used for programming.
User Dspy Time	Set the wait time for the User Display or enable/disable it.
User Dspy Video	Select Reverse or Normal video for the Frequency and User Display lines.
Reset User Dspy	Return all the options for the User Display to factory default values.

Viewing and Editing Parameters

The PowerFlex 70 drive is initially set to Basic Parameter View. To view all parameters, set parameter 196 [Param Access Lvl] to option 1 "Advanced". Parameter 196 is not affected by the Reset to Defaults function.

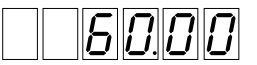
LCD HIM

Step	Key(s)	Example Displays
1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to "Parameter."		
2. Press Enter. "FGP File" appears on the top line and the first three files appear below it.		
3. Press the Up Arrow or Down Arrow to scroll through the files.		
4. Press Enter to select a file. The groups in the file are displayed under it.		
5. Repeat steps 3 and 4 to select a group and then a parameter. The parameter value screen will appear.		
6. Press Enter to edit the parameter.		
7. Press the Up Arrow or Down Arrow to change the value. If desired, press Sel to move from digit to digit, letter to letter, or bit to bit. The digit or bit that you can change will be highlighted.		
8. Press Enter to save the value. If you want to cancel a change, press Esc.		
9. Press the Up Arrow or Down Arrow to scroll through the parameters in the group, or press Esc to return to the group list.		

Numeric Keypad Shortcut

If using a HIM with a numeric keypad, press the ALT key and the +/– key to access the parameter by typing its number.

LED HIM

Step	Key(s)	Example Displays
1. Press Esc until the Output Frequency screen appears. This screen displays the frequency of the drive if it is running. If the drive is stopped, it will display 0.	Esc	
2. Press Enter. The parameter that was last viewed appears. Its file letter will flash.	Enter	
3. Press the Up Arrow or Down Arrow to scroll through the files.	Up or Down	
4. Press Enter to enter a file. The right digit will then flash.	Enter	
5. Press the Up Arrow or Down Arrow to scroll through the parameters that are in the file. An "n" appears after a number if a parameter is a bit parameter that is divided into nibbles.	Up or Down	
6. Press Enter to view the value of a parameter or nibble. Its value will be displayed. If you do not want to edit the value, press Esc to return to the parameter list.	Enter	
7. Press Enter to enter edit mode. The right digit will flash if it can be edited.	Enter	
8. Press the Up Arrow or Down Arrow to change the value. If desired, press Sel to move from digit to digit or bit to bit. The digit or bit that you can change will flash. To change a sign in a signed value, press Sel to move the cursor to the left-most digit. Then, press the Up Arrow or Down Arrow to scroll to the desired sign.	Up or Down Sel	
9. Press Enter to save the value. If you want to cancel a change, press Esc. The value will stop flashing to indicate that you are no longer in edit mode.	Enter	
10. Press Esc to return to the parameter list.	Esc	

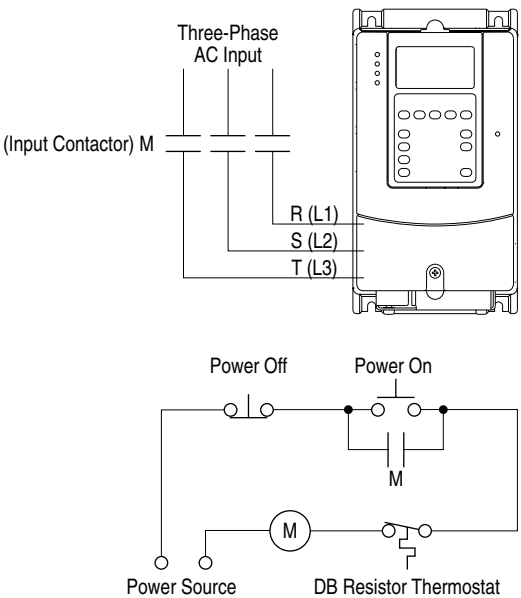
Application Notes

For information on…	See page…
External Brake Resistor	C-1
Skip Frequency	C-2
Stop Mode	C-4
Motor Overload	C-6

For information on…	See page…
Start At PowerUp	C-7
Overspeed	C-8
Process PI for Standard Control	C-9

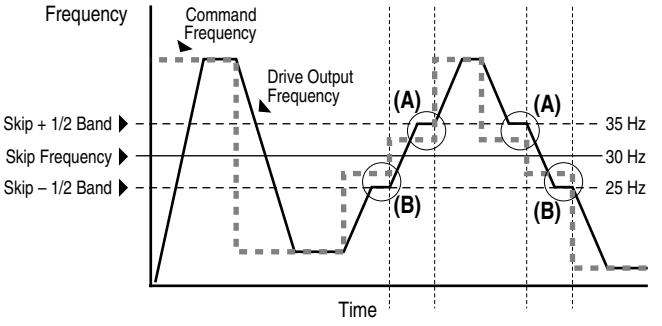
External Brake Resistor

Figure C.1 External Brake Resistor Circuitry



Skip Frequency

Figure C.2 Skip Frequency



Some machinery may have a resonant operating frequency that must be avoided to minimize the risk of equipment damage. To assure that the motor cannot continuously operate at one or more of the points, skip frequencies are used. Parameters 084-086, ([Skip Frequency 1-3]) are available to set the frequencies to be avoided.

The value programmed into the skip frequency parameters sets the center point for an entire “skip band” of frequencies. The width of the band (range of frequency around the center point) is determined by parameter 87, [Skip Freq Band]. The range is split, half above and half below the skip frequency parameter.

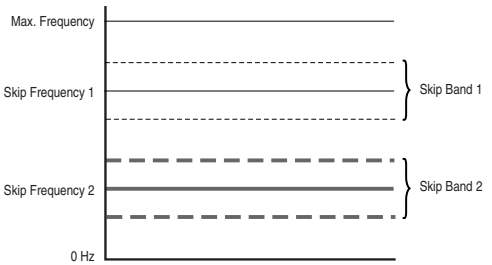
If the commanded frequency of the drive is greater than or equal to the skip (center) frequency and less than or equal to the high value of the band (skip plus 1/2 band), the drive will set the output frequency to the high value of the band. See (A) in Figure C.2.

If the commanded frequency is less than the skip (center) frequency and greater than or equal to the low value of the band (skip minus 1/2 band), the drive will set the output frequency to the low value of the band. See (B) in Figure C.2.

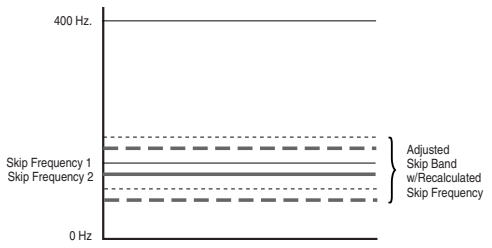
Acceleration and deceleration are not affected by the skip frequencies. Normal accel/decel will proceed through the band once the commanded frequency is greater than the skip frequency. See (A) & (B) in Figure C.2. This function affects only continuous operation within the band.

Skip Frequency Examples

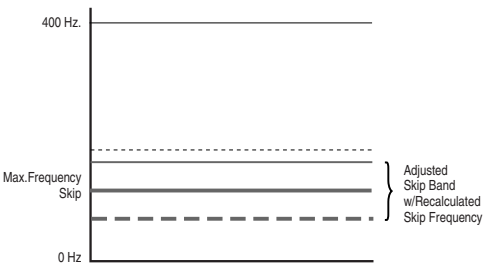
The skip frequency will have hysteresis so the output does not toggle between high and low values. Three distinct bands can be programmed. If none of the skip bands touch or overlap, each band has its own high/low limit.



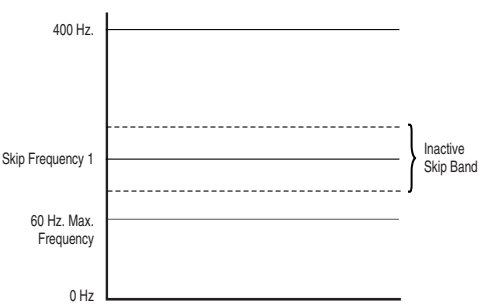
If skip bands overlap or touch, the center frequency is recalculated based on the highest and lowest band values.



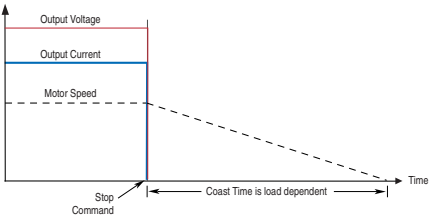
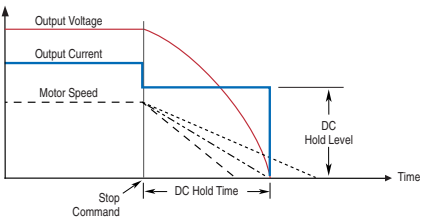
If a skip band(s) extend beyond the max frequency limits, the highest band value will be clamped at the max frequency limit. The center frequency is recalculated based on the highest and lowest band values.

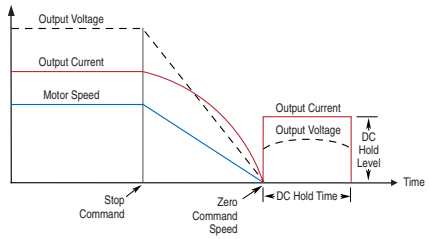
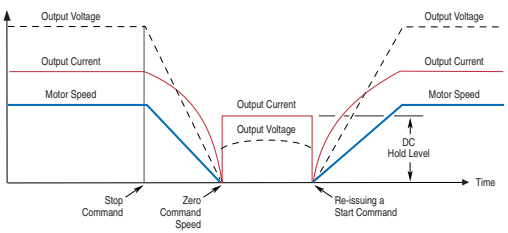


If the band is outside the limits, the skip band is inactive.



Stop Mode

Mode	Description
Coast to Stop	 This method releases the motor and allows the load to stop by friction. 1. On Stop, the drive output goes immediately to zero (off). 2. No further power is supplied to the motor. The drive has released control. 3. The motor will coast for a time that is dependent on the mechanics of the system (inertia, friction, etc).
Brake to Stop	 This method uses DC injection of the motor to Stop and/or hold the load. 1. On Stop, 3 phase drive output goes to zero (off) 2. Drive outputs DC voltage on the last used phase at the level programmed in [DC Brake Level] Par 158. This voltage causes a “stopping” brake torque. If the voltage is applied for a time that is longer than the actual possible stopping time, the remaining time will be used to attempt to hold the motor at zero speed. 3. DC voltage to the motor continues for the amount of time programmed in [DC Brake Time] Par 159. Braking ceases after this time expires. 4. After the DC Braking ceases, no further power is supplied to the motor. The motor may or may not be stopped. The drive has released control. 5. The motor, if rotating, will coast from its present speed for a time that is dependent on the mechanics of the system (inertia, friction, etc).

Mode	Description
Ramp to Stop	 This method uses drive output reduction to stop the load. 1. On Stop, drive output will decrease according to the programmed pattern from its present value to zero. The pattern may be linear or squared. The output will decrease to zero at the rate determined by the programmed [Maximum Freq] and the programmed active [Decel Time x] 2. The reduction in output can be limited by other drive factors such as bus or current regulation. 3. When the output reaches zero the output is shut off. 4. The motor, if rotating, will coast from its present speed for a time that is dependent on the mechanics of the system (inertia, friction, etc).
Ramp to Hold	 This method combines two of the methods above. It uses drive output reduction to stop the load and DC injection to hold the load at zero speed once it has stopped. 1. On Stop, drive output will decrease according to the programmed pattern from its present value to zero. The pattern may be linear or squared. The output will decrease to zero at the rate determined by the programmed [Maximum Freq] and the programmed active [Decel Time x] 2. The reduction in output can be limited by other drive factors such as bus or current regulation. 3. When the output reaches zero 3 phase drive output goes to zero (off) and the drive outputs DC voltage on the last used phase at the level programmed in [DC Brake Level] Par 158. This voltage causes a “holding” brake torque. 4. DC voltage to the motor continues until a Start command is reissued or the drive is disabled. 5. If a Start command is reissued, DC Braking ceases and the drive returns to normal AC operation. If an Enable command is removed, the drive enters a “not ready” state until the enable is restored.

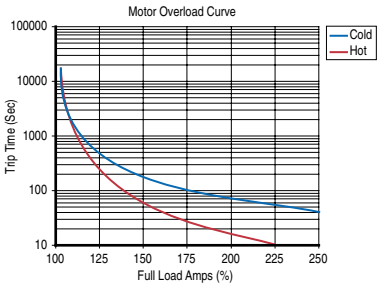
Motor Overload

For single motor applications the drive can be programmed to protect the motor from overload conditions. An electronic thermal overload I^2T function emulates a thermal overload relay. This operation is based on three parameters; [Motor NP FLA], [Motor OL Factor] and [Motor OL Hertz] (parameters 042, 048 and 047, respectively).

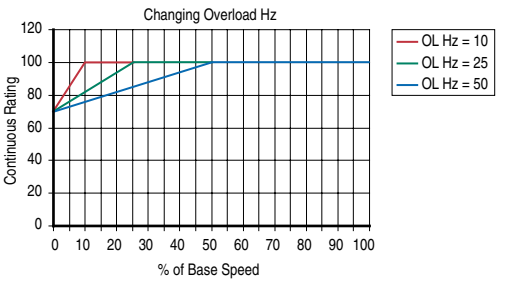
[Motor NP FLA] is multiplied by [Motor OL Factor] to allow the user to define the continuous level of current allowed by the motor thermal overload. [Motor OL Hertz] is used to allow the user to adjust the frequency below which the motor overload is derated.

The motor can operate up to 102% of FLA continuously. If the drive had just been activated, it will run at 150% of FLA for 180 seconds. If the motor had been operating at 100% for over 30 minutes, the drive will run at 150% of FLA for 60 seconds. These values assume the drive is operating above [Motor OL Hertz], and that [Motor OL Factor] is set to 1.00.

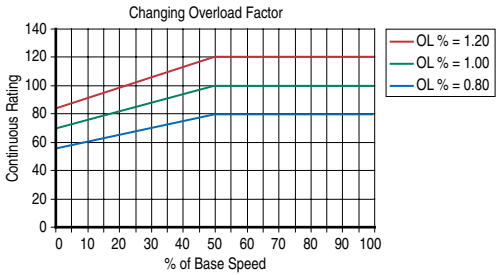
Operation below 100% current causes the temperature calculation to account for motor cooling.



[Motor OL Hertz] defines the frequency where motor overload capacity derate should begin. The motor overload capacity is reduced when operating below [Motor OL Hertz]. For all settings of [Motor OL Hertz] other than zero, the overload capacity is reduced to 70% at an output frequency of zero.



[Motor NP FLA] is multiplied by [Motor OL Factor] to select the rated current for the motor thermal overload. This can be used to raise or lower the level of current that will cause the motor thermal overload to trip. The effective overload factor is a combination of [Motor OL Hertz] and [Motor OL Factor].



Start At PowerUp

When Start At Powerup in 2 wire control is configured, the drive will start if all start permissive conditions are met (within 10 seconds of drive power being applied), and the terminal block start input (Run, Run Forward or Run Reverse for 2-wire) is closed. An alarm will be annunciated from application of power until the drive actually starts, indicating the powerup start attempt is in progress.

The powerup start attempt will be aborted if any of the following occurs anytime during the 10-second start interval:

- A fault condition occurs
- A Type 2 alarm condition occurs
- The terminal block programmed enable input is opened
- All terminal block run, run forward, or run reverse, inputs are canceled
- A Stop request (from any source) is received

If the drive has not started within the 10 second interval, the powerup start attempt will be terminated.

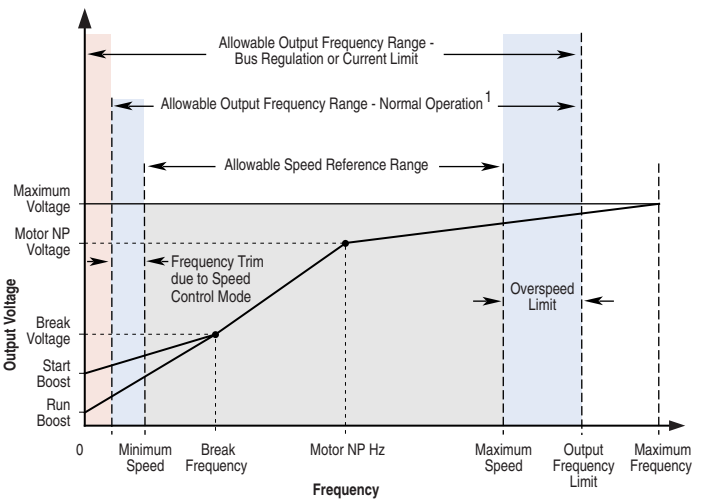
Overspeed

Overspeed Limit is a user programmable value that allows operation at maximum speed, but also provides an “overspeed band” that will allow a speed regulator such as encoder feedback or slip compensation to increase the output frequency above maximum speed in order to maintain maximum motor speed.

The figure below illustrates a typical Custom V/Hz profile. Minimum Speed is entered in Hertz and determines the lower speed reference limit during normal operation. Maximum Speed is entered in Hertz and determines the upper speed reference limit. The two “Speed” parameters only limit the speed reference and not the output frequency.

The actual output frequency at maximum speed reference is the sum of the speed reference plus “speed adder” components from functions such as slip compensation.

The Overspeed Limit is entered in Hertz and added to Maximum Speed and the sum of the two (Speed Limit) limit the output frequency. This sum (Speed Limit) must is compared to Maximum Frequency and an alarm is initiated which prevents operation if the Speed Limit exceeds Maximum Frequency.



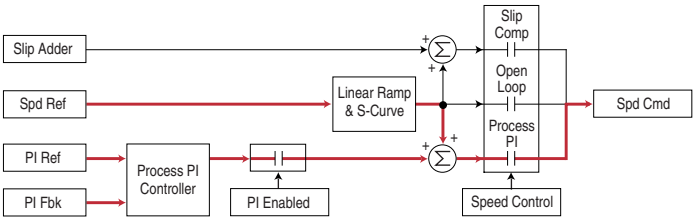
Note 1: The lower limit on this range can be 0 depending on the value of Speed Adder

Process PI for Standard Control

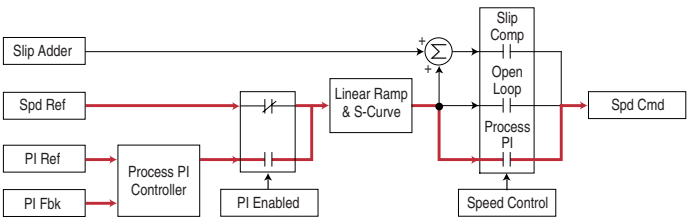
The internal PI function of the PowerFlex 70 provides closed loop process control with proportional and integral control action. The function is designed for use in applications that require simple control of a process without external control devices. The PI function allows the microprocessor of the drive to follow a single process control loop.

The PI function reads a process variable input to the drive and compares it to a desired setpoint stored in the drive. The algorithm will then adjust the output of the PI regulator, changing drive output frequency to try and make the process variable equal the setpoint.

It can operate as trim mode by summing the PI loop output with a master speed reference.

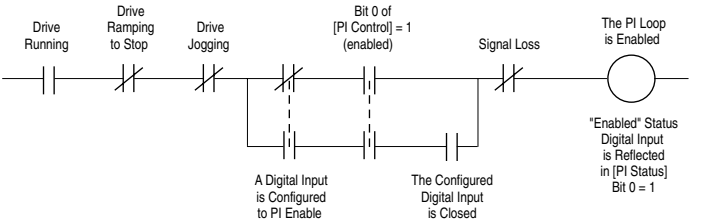


Or, it can operate as control mode by supplying the entire speed reference. This method is identified as “exclusive mode”



PI Enable

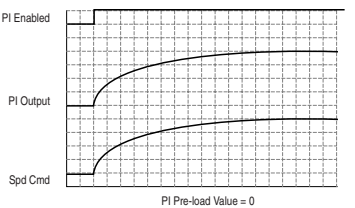
The output of the PI loop can be turned on (enabled) or turned off (disabled). This control allows the user to determine when the PI loop is providing part or all of the commanded speed. The logic for enabling the PI loop is shown in below.

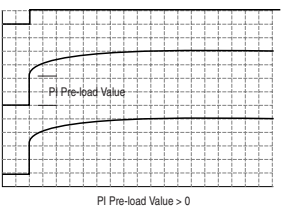

Drive Running
Drive Ramping to Stop
Drive Jogging
Bit 0 of [PI Control] = 1 (enabled)
Signal Loss
The PI Loop is Enabled
"Enabled" Status Digital Input is Reflected in [PI Status] Bit 0 = 1
A Digital Input is Configured to PI Enable
The Configured Digital Input is Closed

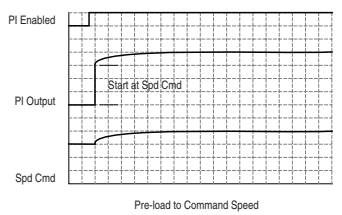
The drive must be running for the PI loop to be enabled. The loop will be disabled when the drive is ramping to a stop, jogging or the signal loss protection for the analog input(s) is sensing a loss of signal.

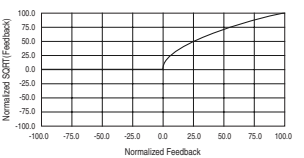
If a digital input has been configured to “PI Enable,” two events are required to enable the loop: the digital input must be closed AND bit 0 of the PI Control parameter must be = 1.

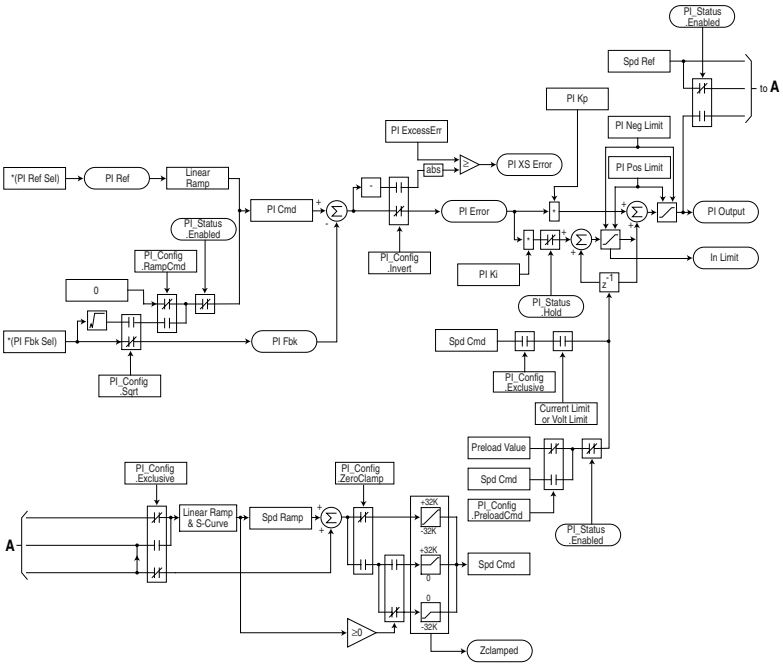
If no digital input is configured to “PI Enable,” then only the Bit 0 = 1 condition must be met. If the bit is permanently set to a “1”, then the loop will become enabled as soon as the drive goes into “run”.







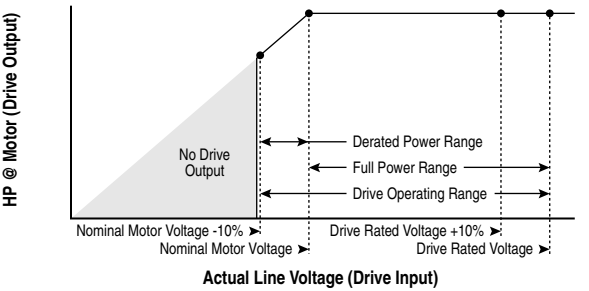



PI_Status .Enabled
Spd Ref
to A
PI Kp
PI Neg Limit
PI ExcessErr
PI XS Error
PI Pos Limit
*(PI Ref Sel)
PI Ref
Linear Ramp
PI Cmd
PI Error
PI Output
PI_Status .Enabled
PI_Config .RampCmd
PI_Config .Invert
In Limit
PI Ki
0
PI_Status .Hold
*(PI Fbk Sel)
PI Fbk
Spd Cmd
PI_Config .Sqrt
PI_Config .Exclusive
Current Limit or Volt Limit
Preload Value
PI_Config .Exclusive
PI_Config .ZeroClamp
Spd Cmd
A
Linear Ramp & S-Curve
Spd Ramp
PI_Config .PreloadCmd
PI_Status .Enabled
+32K
-32K
Spd Cmd
0
Zclamped

Voltage Tolerance

Drive Rating	Nominal Line Voltage	Nominal Motor Voltage	Drive Full Power Range	Drive Operating Range
200-240	200	200†	200-264	180-264
	208	208	208-264	
	240	230	230-264	
380-400	380	380†	380-528	342-528
	400	400	400-528	
	480	460	460-528	
500-600	600	575†	575-660	432-660

Drive Full Power Range =	Nominal Motor Voltage to Drive Rated Voltage + 10%. Rated current is available across the entire Drive Full Power Range
Drive Operating Range =	Lowest† Nominal Motor Voltage - 10% to Drive Rated Voltage + 10%. Drive Output is linearly derated when Actual Line Voltage is less than the Nominal Motor Voltage

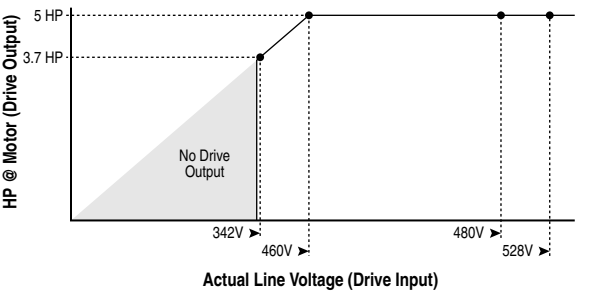


Example:

Calculate the maximum power of a 5 HP, 460V motor connected to a 480V rated drive supplied with 342V Actual Line Voltage input.

- Actual Line Voltage / Nominal Motor Voltage = 74.3%
- 74.3% × 5 HP = 3.7 HP
- 74.3% × 60 Hz = 44.6 Hz

At 342V Actual Line Voltage, the maximum power the 5 HP, 460V motor can produce is 3.7 HP at 44.6 Hz.



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